Electrical World

JUN 27

JUNE 22, 1946

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Congress has acted—and along these lines—since this editorial was written. If the President signs the legislation, we have taken one step forward. If he vetoes it, the voters must resolve a conflict between two branches of their government.

THE LABOR CRISIS
—*it's up to Congress*

IT HAS remained for John L. Lewis to demonstrate conclusively that, under the sponsorship of the federal government, the power of organized labor has been built up to a point where it can be used to paralyze the economic life of the nation. Therefore, in the elemental interest of self-preservation, the first order of the day is to cut down the power of organized labor to a point where irresponsible leaders no longer have the power to use it to cut down the country.

This will prove an exceedingly complicated job. The federal government, over a dozen years, has developed and buttressed the power of organized labor by many separate steps. They are interlaced in a pattern which cannot easily be unravelled.

Cutting down the power of organized labor to proper proportions will be an operation almost as delicate as brain surgery. To be successful it must impair no basic American political or economic right. It must leave intact the right of workers to organize and bargain collectively through representatives of their own choosing. It must leave intact the right to strike. But it must disassociate from the exercise of these rights opportunities for devastating abuse of the public welfare such as those demonstrated by Mr. Lewis. A meat axe is not the instrument for this operation.

Because of the complexity and delicacy of the operation to be performed it would be helpful if it could be carried out in a tranquil atmosphere. The urgency of the problem is such, however, that no time can be lost in getting at it.

Guiding Principles

However, the dangers that haste or heat will lead to serious blunders can be largely eliminated if the process of bringing the power of organized labor back within safe and reasonable bounds is governed by principles to which all fair minded people can fully subscribe.

The most important of these principles is that it is an abuse of public authority to extend special privileges to organized labor.

When in 1935 Congress passed the Wagner Labor Relations Act, one of the great buttresses of the power of organized labor, it was upon the explicit theory that organized labor was weak and needed coddling by the federal government if it were to survive, let alone grow big and strong. In the policy section of that act it was stated that "the inequality of bargaining power between employees who do not possess full freedom of association or actual liberty of contract, and employers who are organized in the corporate or other forms of ownership association substantially burdens and affects the flow of commerce . . . "

Regardless of whether or not that was a correct reflection of the situation in 1935, it bears no relation to the situation today. Under the continuous sponsorship of the federal government, the power and bulk of organized labor has waxed until today it is preposterous to regard it as the weak sister in its bargaining with employers. If, after being continuously demonstrated since V-J Day, the proposition that the pendulum of organized power has swung too far over on the side of organized labor needed any final and clinching demonstration, John L. Lewis provided it.

Changes in the Law

Translation of the principle that organized labor is no longer a weakling, requiring a diet of special privileges, into specific legislative enactments is a detailed technical operation beyond the scope of this statement. It is possible, however, to indicate some of the general lines it should follow. Here they are:

1. The duty to bargain collectively, now imposed upon employers by the Wagner Act, should also be imposed upon the leaders of organized labor who are now under no legal compulsion to bargain.

   For well over a month Mr. Lewis made a complete mockery of the process of collective bargaining by refusing even to state his demands until the coal operators had approved "in principle" a plan for a miners' "health and welfare" fund which he fancied. In the meantime the country was plunged into an ever deepening crisis.

2. Unions, as well as employers, should be made liable to suit for damages for breaking their collective bargaining agreements.

   A degree of responsibility commensurate with their age and power requires that unions be liable, to the extent of union funds but not the funds of individual members, for carrying out their agreements. To have it otherwise is to hold that a collective bargaining agreement is, by defi-

nition, a phoney agreement so far as the union is concerned. Outlaw strikes are the fruit of this lop-sided arrangement.

3. Employers should be given more discretion, in reinstating employees who have gone on strike than is now permitted by the Wagner Act.

The Wagner Act largely eliminates the risks involved in striking because of the requirements it imposes upon employers to take workers back when they have decided to return to work. These requirements make it virtually impossible for the employer to replace workers even if they are engaged in the most unjustifiable of strikes. At the least workers who have smashed up property and stirred up violence in the course of a strike should have no rights under the Wagner Act. How much further the Wagner Act straitjacket should be loosened at this point should be carefully explored, and excesses encouraged by the Act should be removed.

4. The wedge which the National Labor Relations Board has driven into the orderly conduct of American industry by holding that foremen are covered by the Wagner Act should be eliminated.

The issue involved here is continuously mislabelled and confused as that of the right of foremen to organize. There is no question of the right of foremen to organize any kind of a legal organization they desire. That is their right as American citizens. The issue is whether or not the special privileges accorded by the Wagner Act, which in some circumstances has been so construed as even to prevent employers from talking with their workers, should be extended to foremen who, if American industry is to have a chance to do its duty effectively, must represent management with full loyalty and responsibility.

A member of John L. Lewis' United Mine Workers takes an oath which provides, in part, "that I will not reveal to any employer or boss the name of anyone a member of our union" and will "defend on all occasions and to the extent of my ability the members of our organization." Mr. Lewis insists that the coal operators contract to deal with foremen to be organized in a union where they will take that oath, and where their activities will be separated from the influence of employers by the barriers imposed by the Wagner Act. Such an arrangement undercuts orderly management of American industry.

5. The exemption of labor unions from the federal anti-trust laws, provided when organized labor was presumed to be weak, should be modified to take account of its vastly increased strength, and the use of this strength to destroy business enterprise and create monopoly.

As matters stand unions can run employers completely out of business by secondary boycotts and run fellow workers out of jobs in the process. An Ohio manufacturer, working with a government-certified C. I. O. union, is put out of business because A. F. of L. workers refuse to handle his products. Still the government, this time in the person of the United States Supreme Court, says that actions of this sort are above the law because Congress exempted unions from the federal anti-trust laws.

To eliminate one of the most devastating forms of restraint of trade, this exemption should be cut down forthwith by subjecting unions imposing secondary boycotts to the same penalties under the federal anti-trust laws as those to which employers doing the same thing are subjected. And the question of further narrowing the obsolete exemption of unions from the federal anti-trust laws should be fully explored.

6. The levying of special sales taxes for the exclusive benefit of unions should be prohibited by law.

As a matter of good government the right to levy consumption taxes should be reserved to the public authorities and used strictly for public purposes. As a matter of good economics, payments to workers or their organizations should be included in the payroll where they can be properly counted as part of the cost of production.

Equality Before the Law

When everything that can conceivably be accomplished by legislation has been accomplished there is no reason to believe that an ideal or even a surely workable system of industrial relations will have been devised. Many of the mainsprings of such a system lie deep in the hearts of men and far beyond the reach of legislation. There is no chance, however, of having such a system, or even a defensible system of democratic government until special privileges which tip the scales of power far on the side of organized labor are withdrawn and there is some measure of equality for employers and organized labor before the law. Though it is hard to believe it at the moment the country may come to be grateful to John L. Lewis for driving that lesson home so ruthlessly.

President, McGraw-Hill Publishing Company, Inc.

Electrical World

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Atomic Power

By offering to share the atomic energy secret with the world provided the world would take measures to prevent the use of atomic bombs in warfare, the United States has taken the first step toward hastening the day when this new form of energy can take its place as a tool of peace. So long as the fear of sudden destruction hangs over the world it is unlikely that this or any other government will release to industry the material necessary for application research.

When UNO accepts the offer we have made and sets up the necessary control organization our government's main interest should be to see that its investment in the two nuclear fission plants is used as advantageously as possible to explore areas of possible industrial application. At the same time we would expect the government to encourage civilian industrial experimentation and investigation. In fact, as soon as the world makes up its mind that atomic weapons can and will be outlawed, the responsibility for developing peace-time uses falls on industry.

There must, of course, be regulation to prevent any accumulation of bomb material in improper hands. To the utility industry such regulation holds no terrors, provided it isn't restrictive to the point of insisting on government ownership. It is understandable that the government, if for security reasons it is to continue to be the source of readily fissionable materials, should utilize the heat and extract as much byproduct electric power as possible. In that event, it would be reasonable to expect the same marketing rules to apply as govern other multi-purpose projects, one element of which is power.

There is no fear in the industry that atomic energy will obsolete present generating plant overnight. It might some day, but that is still a long way off.

Even after a method for using atomic fuel has been designed it will need years of pilot operation to collect the information necessary for commercial application. Many alternatives will have to be explored and data collected on many things not experienced in previous power plant operations. Radiation, for instance, presents a problem that cannot just be partially solved; protection must be positive and ample.

At the same time if there is any possibility the atomic energy will prove practical the sooner the knowledge is had the better. It would be fine if an alternative fuel were available that could be used at the same or less cost than coal if for no other reason than the protection to service continuity in case of another miners' strike.

Thoughtful people everywhere will breathe a big sigh of relief when UNO accepts the proposition made last week by the United States and says in behalf of the world that there will be no more atomic bombing. It won't be long after that before a clamor will set up for a taste of some of the fruits of atomic research. Unfortunately, however, the public will have to wait, for however good the visions of some of our atomic enthusiasts might be, their timing has not been good. That perhaps is the most important reason why private industry should begin its exploratory work just as early as possible. If there is to be an atomic age, the sooner the better.

SOUTHWARK STATION

Aimed to be Simple and Reliable

ERNEST L. HOPPING *Mechanical Engineer, Philadelphia Electric Co.*

Conservative decision reflected in choice of 850 psi. and 900 F. influenced by prospective capacity factor with appropriate operating economy—Simple layout to facilitate operation and maintenance—Commitments founded on extensive model tests—Ventilating air supply given much thought—Cross-compound turbine—Improvements incorporated in boilers

AS EARLY AS 1930, it had been considered essential that a steam-electric generating station should eventually be constructed in the general vicinity of the finally selected location for Southwark Station. The property, on the Delaware River at the foot of Porter St. on the southeastern boundary of Philadelphia, was found to have the features requisite* to a generating station of the contemplated type and capacity. The plot was purchased in January, 1940, and preliminary studies were undertaken. Final major design characteristics of the station were approved early in 1941, and construction was started in August of that year. The plant is scheduled to be placed in operation this autumn.

Early in 1942, because of the war situation and scarcity of materials, the design was reviewed in an effort to reduce the use of critical materials and equipment. The War Production Board granted permission to proceed on a somewhat restricted basis, but when the material and equipment situation become more acute the board, in August, 1942, ordered construction stopped. In September, 1944, they approved resumption of the project; thereafter, the design was speeded up, contracts reopened and construction resumed. Several phases of the station were improved because of experience gained during the elapsed period and because of more advanced thinking and review of some of the design features.

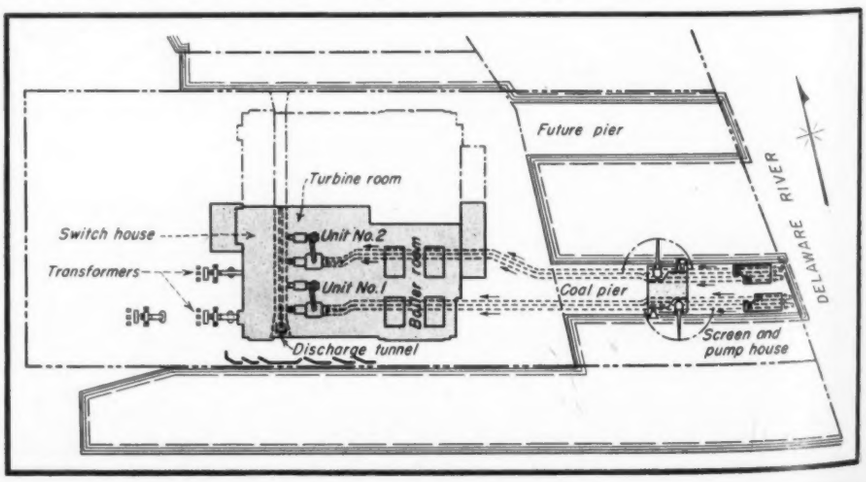
Planning and Design

The planning of Southwark Station and its engineering design and layout were done within the Philadelphia Electric Co. organization where exceptionally close cooperation exists between the operating and engineering forces, thereby creating a situation favorable to the most advantageous design. The engineers have continuous contact with operating practices and gain the benefit derived from cooperative effort in correction of faults developing during operation. Operating and engineering personnel are also continuously alert to problems involved in station improvement and maintenance.

It is realized that engineering carried out by an organization having a somewhat limited field of experience may become static. To offset this possibility, the company encourages very active participation by its engineering and operating forces in committee work of technical and industry organizations. There the contact with other engineers and the exchange of ideas constantly going on keeps the men in the organization always in touch with the most advanced thinking in their field.

As a means of further insuring the soundness of the plans, the company encourages the retaining of consulting experts on specialized phases of the design. For Southwark Station prominent consultants were engaged on particular problems connected with foundations, certain mechanical features,

FIG. 1—Ground plan of Southwark Station on Delaware River



* Factors affecting station location from the standpoint of system distribution, and features of the electrical planning appear in an article by L. R. Gaty and E. B. Shew in a subsequent issue.

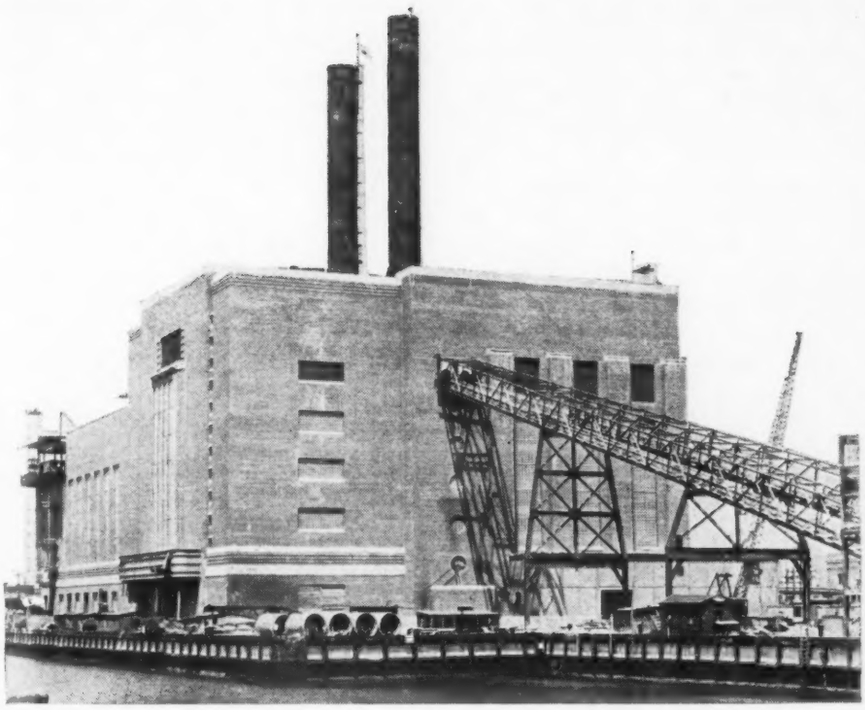


FIG. 2—The station will be of Colonial red brick construction with glass block panels for light and louvered, dampered openings for combustion air and for ventilation. Offices are at opposite corner of this building

metallurgy, chemistry, hydraulics and architecture.

A special problem where such services were utilized was encountered in connection with building and equipment foundations. A program of soil and foundation tests was used.

When the design of a new station such as Southwark is started, the operating department selects the future superintendent, who is then assigned to work with the engineering department, and he participates directly in the design. All matters of major importance, such as selection of equipment and fundamental design features, are the result of cooperative action by the two departments. (See Walker and Hagy, "Mechanical-Electrical Design of Power Plants Coordinated", ELECTRICAL WORLD, May 15, 1943, pages 63-65).

Station Pattern

Two units are being installed at this time, the first one scheduled for operation in the fall of 1946 and the second for operation about a year later. Each unit comprises a Westinghouse 150,000-kw., 0.8-p.f., cross-compound main turbo-generator, one Allis-Chalmers 12,500-kw., 0.8-p.f., auxiliary turbo-generator, and two Babcock and Wilcox open-pass boilers, each with a continuous rated capacity of 850,000 lb. of steam per hour. The throttle steam conditions are 850 psi., 900 deg. F., with an average main condenser vacuum of about 29 in. Each complete unit with its necessary auxiliaries will operate independently of the other station units and there will be no cross connections.

Four Babcock and Wilcox coal pulverizing mills per boiler are of sufficient capacity that coals having a grindability as low as 55 can be used at practically full rated boiler output.

Coal for this station, supplied mostly from Pennsylvania or West Virginia areas, will be delivered normally by barges loaded from nearby coal terminals. For emergency, in case of tie-up of river facilities, coal can be delivered directly by rail.

Circulating water will be taken from the end of the pier, shown in Fig. 2, and delivered from pumps through precast concrete pipes to the station condensers about 750 ft. away. Water will be discharged into the slip on the south side of the property.

Pressure and Temperature

In early discussions of possible steam conditions, it was believed that 850 psi., 900 deg. F. at the turbine throttle would prove most attractive from the standpoint of investment and operating costs for the estimated average load conditions expected at the station throughout its lifetime. For this reason complete capital and operating cost estimates were made on that basis. Two other throttle conditions, namely 850 psi. with 925 deg. F. and 1,250 psi. with 925 deg. F., were later considered and for these conditions estimates were prepared covering those items which would have a differential cost. Operating savings in each of these latter cases were substantially less than would be required to justify the added investments. Because of the size of the station and the great importance of making a correct decision, it was felt advisable to have the report of the company engineers independently reviewed. Therefore, one of the leading consultants in this field, Professor A. G. Christie, of Johns Hopkins University, was engaged to study and comment on the engineers' recommendations, and his final conclusions were in agreement. The plant design, therefore, proceeded on the basis of 850 psi. at 900 deg. F.

Conservative Decision

While economics alone was sufficient to justify the selected conditions, the more conservative pressure and temperature were believed to favor the important factor of reliability. Experience with metals and with equipment at the higher pressures and temperatures, which had been utilized mostly for topping units, had been of such short duration that it was believed faults might be disclosed in long-time service which could not be predicted on the basis of laboratory tests or short-time experience. This belief was confirmed when serious trouble developed on another system in the form of graphitization in the carbon-molybdenum piping which, previously, was believed to be entirely satisfactory for high-temperature service. The industry is still carrying on considerable research to develop the most suitable materials for this type of service. Philadelphia Electric Co. is continuing an extensive research program to determine the safe life of carbon-molybdenum and carbon-steel piping now in high-temperature service in three of its existing stations.

There had been excessive tube corrosion on the surfaces exposed to the combustion chambers of certain high-

pressure boilers which has been definitely reduced by alterations to burners and improvements in fuel and air distribution in the furnace. It is thought, however, that the use of heavy wall tubes, necessary for high pressure, may have been partially instrumental in bringing about this corrosion. The heavy walls, combined with the higher saturated steam temperatures within the tubes, result in a relatively high tube surface temperature, thereby creating a metal condition more critical to slag corrosion than would occur in lower pressure boilers.

Capacity Factor

An important item, which had a bearing on the selected pressure and temperature, was that the 50 percent capacity factor used in the basic study was probably high, and any reduction of this figure would result in a still lower return on the incremental investment required for higher pressures and temperatures. A study of past records of company turbo-generators reveals a lower capacity factor for the average life of most of the older existing and the retired units. Also, since Philadelphia Electric Co. System has a substantial hydroelectric capacity as well as several relatively efficient steam stations, the capacity factor for Southwark Station units may well be lower than the estimated figure.

About the time this study was being made, other companies were going through the same process, and it is apparent from the selection of pressure and temperature for many new stations and new unit installations that the same conclusions have been reached by others. Of all new units, other than those for superposition, reported by the Association of Edison Illuminating Companies since Southwark Station was planned, over 50 percent are to operate at its pressure and temperature.

Turbine Rating

The sizes of the turbines and boilers for this station were selected only after numerous plant layouts were studied to effect the best arrangement and to determine the maximum station capacity that could be installed on the property. The location on the Delaware River excluded the necessity of special studies regarding limitations imposed by supply of circulating water. Property size, sizes of other turbines on the Philadelphia Electric or in its interconnected systems and system capacities were major factors.

Since this company already had one turbo-generator of 165,000-kw. capacity with provisions in the same plant for installation of a second similar machine, sizes up to that maximum were to be considered. Philadelphia Electric System alone would have an installed capacity of over 1,200,000 kw. and would be interconnected to an integrated system having a capacity of approximately 5,000,000 kw. It was believed, therefore, that sizes up to the maximum already existing would be suitable for the new station.

Five different types of units, each of 100,000-kw. capacity and of standard design, were selected for the preliminary studies, and station arrangements were prepared for each of them. The types selected were single-casing, single-flow, 1,800-rpm.; tandem-compound, double-flow, 1,800-rpm.; cross-compound, quadruple-flow with both elements at 3,600 rpm.; cross-compound, single-flow at 3,600 and 1,800 rpm., respectively, for high- and low-pressure turbines; and cross-compound, double-flow with 3,600 and 1,800 rpm., respectively, for high- and low-pressure turbines. The latter cross-compound type was chosen for further study because it was the most desirable insofar as station arrangement was concerned; was the most efficient in respect to heat rate and, except for the single-casing turbine, was lower priced than the other types of the same capacity. The single-casing had the highest heat rate and was not available in larger size.

Preliminary layouts soon developed the fact that it would be desirable to plan the station for larger size units in order to provide the maximum ultimate capacity on the property. Larger units also gave the advantage of lower cost per kw. of installed capacity. Therefore, the final plans and estimate included 150,000-kw., cross-compound turbines using already developed sizes for the high- and low-pressure elements. These were 65,000 kw., 3,600 rpm. for the high-pressure turbine and 85,000 kw., 1,800 rpm. for the low-pressure turbine.

Basic Approach in Southwark Design

As a guide in the general design of Southwark Station, a few fundamental factors were laid down, not necessarily in the order of their importance, as follows:

1. Pressure and Temperature

The pressure and temperature selected must be economically suitable for an estimated capacity factor not exceeding 50 percent over the life of the station. A duration curve, Fig. 1, was established to serve as a basis for operating costs to be applied to comparative economic studies.

2. Size of Units

Size of the units should be such as to fit into a system having an installed capacity in excess of 1,200,000 kw., with the largest existing unit of 165,000-kw. capacity. It is to be considered that Philadelphia Electric Co. system is part of an operating interconnecting group having a total installed capacity of approximately 5,000,000 kw. Physical property limitations have considerable bearing.

3. Reliability

In selection of equipment and materials, major consideration must be given to reliability of service. The station design should be as simple as possible in order to secure maximum operating reliability and to facilitate operating procedures.

4. Instrumentation

Instruments and control equipment must be selected on the basis of reliability, necessity for operating guidance and record, and for their value as a means of minimizing labor functions. All non-essential items or gadgets should be eliminated for the installation.

5. Employee Facilities

Personnel facilities must be provided and carefully planned from the standpoints of convenience and comfort of employees. Safety hazards must be avoided and equipment arranged for maximum ease of operation.

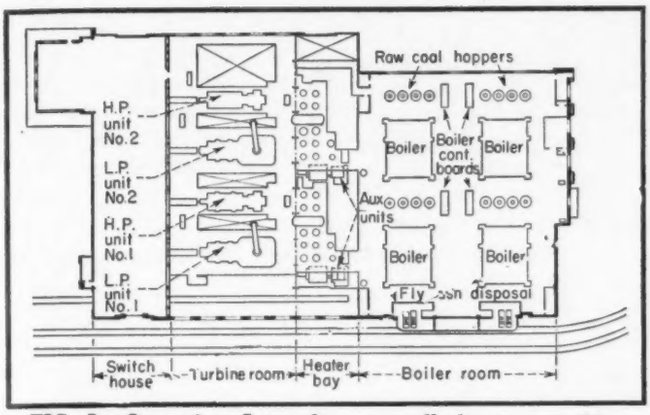


FIG. 3—Operating floor plan, no walls between turbine room, heater bay and boiler room

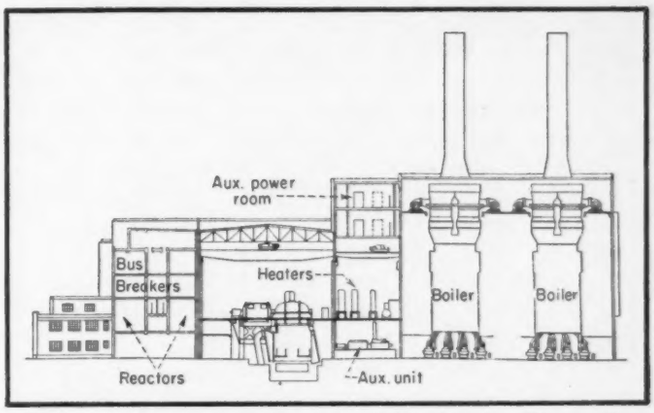


FIG. 4—Cross section elevation of No. 1 unit. Four pulverizing mills serve each boiler

Size of Boilers

Two boilers for one main unit were selected, each capable of continuously providing 850,000 lb. per hour to the main and auxiliary turbo-generators. This is slightly in excess of probable normal maximum demands of nearly 1,600,000 lb. of steam per hour with the turbo-generator operating at 0.9 p.f. and with a vacuum of 29 in. The maximum boiler output required was set at 10 percent above the normal rated capacity or 935,000 lb. per hour, which is sufficient to supply the possible maximum steam requirements of the auxilary and main units, the latter at unity power factor and with 28 in. of vacuum.

Boilers of approximately this size and of the same type were already performing satisfactorily in another utility company's plant and boilers of the same type with 600,000 lb. per hour continuous output were in operation in Philadelphia Electric Co.'s Chester Station. To provide the total capacity through three boilers of the Chester size would have added to the cost of the station and would have required substantially more building area. Both of these factors were of sufficient importance to more than balance any advantage accruing from a larger number of smaller boilers.

Auxiliaries for turbo-generators and for boilers were sized and arranged so that loss of any one would entail, at the most, only a partial loss in capacity on the main unit. For instance, loss of one circulating pump would result in somewhat poorer economy but only a small reduction in capacity, depending on the temperature of the circulating water; one of the three condensate pumps is a spare; one in each bank of low- and high-pressure boiler feed pumps is a spare; loss of a forced- or induced-draft fan would cause not over a 25 percent reduction in the output of the boiler affected.

Turbine Reliability

Cross-compound and tandem-compound turbo-generators were the only types available for the selected capacity of 150,000 kw. While the company already had in operation a 1,800-rpm., tandem-compound machine of approximately the same size, it was believed that the cross-compound type having a high-pressure element of 3,600 rpm., with resulting small high-pressure casing and rotor, offered the advantage of a more rugged, trouble-free design and, therefore, better availability in any standard inspection schedule. Availability of equipment is a major factor in reliable service. It was also believed that this type of unit offers an advantage in respect to over-all outage time required for maintenance.

Improved Boilers

The Babcock and Wilcox open-pass boilers were selected from competitive bids. Consideration was given, however, to the experiences with similar boilers of somewhat smaller size which were in operation at Chester Station. There had been certain development difficulties with these boilers but, in most respects, the experience with them had been satisfactory and the manufacturers offered to incorporate the results of all these experiences in the development of the Southwark boilers.

One illustration of the application of Chester experiences to the Southwark boilers was in connection with the unsatisfactory combustion conditions which, in the beginning, existed in the primary chambers of the Chester boilers. Improper mixing of the air and fuel, after the burners, had resulted in or contributed largely to excessive external tube corrosion. After experimental field changes had improved combustion, it was realized that a more exact knowledge of conditions was necessary. Therefore, as a basis for Southwark design, Philadelphia Electric Co. constructed a 1/10 scale plastic model of the primary combustion chamber and of the primary and secondary air supply passages. The manufacturer furnished scale models of burners and contributed to the cost of the model. Tests were made on fuel and air streams, using inert dust for fuel and chemical smoke in the air. The test program was carried out cooperatively by the company and the manufacturer, and resulted in a substantial improvement in the arrangements for introducing fuel and air.

This and other improvements resulting from Chester experiences should assure the maximum reliability in the Southwark boilers.

Auxiliary Turbo-Generator

Selection of an auxiliary turbo-generator for each main station unit was a direct result of the demand for reliability. It seemed necessary that the power supply to all of the essential auxiliaries, which in this station are motor driven, be particularly reliable because of the size and importance of the station, coupled with the fact that its boilers are fired with pulverized fuel and that four other important stations on the system have substantial pulverized fuel capacity.

A system disturbance might affect the essential auxiliaries, resulting in a loss of fuel supply and air to the boil-

ers, making it necessary to purge them before they could again be placed in service. Such an occurrence could cause considerable interruption to station output and might occur simultaneously with a similar interruption in the other pulverized fuel fired stations on the system.

With an auxiliary turbo-generator, as arranged in this station, there is very little chance that the auxiliary power supply would be in any way affected by a system disturbance. Incidentally, more kilowatts from the main generator are made available to the system.

Simplicity of Arrangement

This feature is illustrated by the arrangement of boilers and turbine units and by the layout of feedwater heaters and their piping described below.

Each main unit, with its auxiliaries, is entirely self-contained, steam to it being supplied by two boilers with an individual auxiliary generator supplying power to its auxiliaries. There are no steam or water connections between units, therefore no pair of boilers can take their feedwater from or supply steam to any other unit in the station. No provision is made to operate the high-pressure or low-pressure end of any main unit independently. With this arrangement the number of valves required is reduced to a minimum. Reliability is improved by this simplicity since the possibilities of operating difficulties with valves, or of operating errors, are greatly reduced. With cross-connection of piping either of these possibilities could seriously affect more than one unit.

Two lines of closed feedwater heaters, with no valves other than at each end of either line, are provided for each main turbo-generator unit. Each stage of heating consists of two partial capacity heaters, one in each of the above lines. Normally, both lines of heaters operating in parallel are in service at all turbine loads. If a failure is experienced in any heater or appurtenance, the complete line in which the failure occurs may be isolated by the motor-operated valves at each end of the line. The second line, however, is continued in service alone until necessary repairs have been completed, when both lines may again be utilized. The loss of a single line would have the effect of lowering the feedwater temperature a few degrees and would limit the turbine load slightly. With single full-capacity heaters, arranged with individual bypasses, loss of the highest temperature heater would entail a comparatively greater effect on economy and capacity. The arrangement with two parallel lines saves a considerable number of valves and simplifies operating procedure in case of trouble. An economic study disclosed that the cost of the double heater arrangement, involving

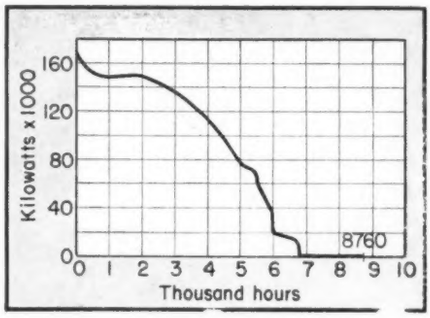


FIG. 5—Estimated average unit-duration curve for the life of the unit represented as a typical year. Capacity factor 50 percent

less complexity, is no greater than that with a single line of larger heaters. The two-line scheme has performed very satisfactorily for several years in two other company stations.

Circulating Water Studies

A paper entitled "Hydraulic-Engineering Problems—Southwark Generating Station," presented to the A.S.M.E. Annual Meeting, in December, 1941, by S. L. Kerr and Stanley Moyer, discusses in detail an extensive model test program to determine the flow distribution for circulating water discharged into the narrow slip on the down-river side of the property. It also discusses a full scale investigation made at the company's Chester Station to determine the temperature distribution pattern from circulating water discharged into a slip. The importance of this study can be realized when it is known that the Delaware is a tidal river at the location of Southwark Station. It is therefore quite important that the heat in the discharge water be dissipated, particularly on the upcoming tide, in order to assure no rise in temperature of the circulating water supply which is taken at a point upstream from the place of discharge.

The 76,000-gpm. Allis-Chalmers vertical circulating pumps and settings were modeled in the manufacturer's laboratory, resulting in improvement in the pump design and in the arrangement for water approach to the pump. The 79,000-sq. ft. Foster-Wheeler surface condenser was modeled by the manufacturer. Tests of water flow resulted in improvement in the design of the water boxes and enabled selection of the best arrangement for water inlet to, and discharge from, the condenser.

Other Model Studies

A very important model study was the primary furnace and burner arrangement, previously discussed under "Improved Boilers."

Models were used in a number of other instances to check designs prepared by the company's engineers; as for instance, a special nozzle to boost the exit gas velocities from the stacks which will undoubtedly result in a better dissipation of stack gases and the uncollectible dust.

In working out satisfactory arrangements for reliably operating and for servicing various pieces of apparatus, a considerable use was made of models. Models were constructed of the boiler gage boards and assembled in various arrangements in reference to the boilers and gage glasses to insure selection of the best scheme to provide the greatest operating reliability and convenience. Similar work was done in respect to maintenance and handling problems for apparatus in constricted locations. In all of this work manufacturers as well as the company's operating and engineering personnel entered into the discussions and study of conditions disclosed by the models.

Instrumentation

Before deciding on the extent of instrumentation to be provided in this station, careful review was made by the engineers and operating personnel of instrumentation provided in existing operating stations. Two instances cited below will exemplify the results of the study which served to crystallize the thoughts of every one concerned as to the justifiable use of instruments in the Southwark design.

a. After reviewing the relative advantages of individual versus central control for soot blowers, it was agreed that central control could not be justified by possible labor saving. It was

also believed that the soot blowers should be operated by a man at the location where he could observe the cleaning results. With blowers operated from a central point, it would still be advisable to inspect the boiler surfaces in the locations cleaned.

b. A survey of operating practices in connection with delivery of coal to the bunkers, through a somewhat complex system, revealed that a substantial labor saving would result from a centralized control and signal board for operation of the successive links in the conveyor system. Therefore, a board was designed, having on it, in a diagram, a plan of the system, with operating switches and indicating lights at damper and apparatus positions. This board, located at the bunker loading level, will serve to indicate the line of flow of coal to the various locations and from it the operator will have knowledge of the functioning of all the apparatus on the system.

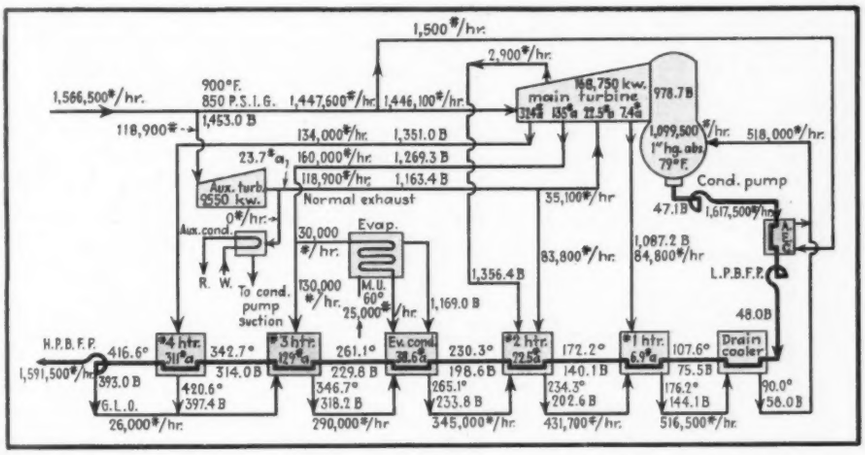


FIG. 6—Heat balance diagram for net output of 168,550 kw. from No. 1 unit. Gross output 178,300 kw., auxiliaries demand 9,750 kw., heat rate 11,340 Btu. per net kw.-hr.

This paper does not attempt to discuss the magnitude of instrumentation but intends only to bring out the method of attack of the problem.

Employee Facilities

Since the early conception of the Southwark Station, facilities for personnel have received much thought by operating and engineering forces. As a result, an administration building, where office and supervisory forces will be housed, is located immediately in front of and abutting the switchhouse, at the center of the ultimate station building. This will be the entrance point for everyone working in or visiting the station. Parking space for employees and visitors is provided at a location convenient to the station entrance. In the administration building, the principal locker and washrooms for station operating, office and supervisory forces will be provided. The maintenance and coal bureau groups will have separate locker and washrooms in their respective buildings.

Inside the station a number of conveniently located wash and toilet rooms are provided, and, in addition, a number of so called utility rooms are to be made available for use of the operating personnel. These utility rooms will be fitted with refrigerators for storing of lunches, hot plates for preparation of hot drinks, etc. Also, they will be equipped with wash sinks, and, in certain locations, with tables and chairs so that a few men may congregate while preparing and eating their lunches.

From past experience with restaurants and as a result of a recent study, it was evident that the utility rooms would be the most satisfactory solution to the eating problem in a generating station with its continuous operating functions. Over a considerable period the company had operated restaurants in four of its generating stations, but they were all finally abandoned because of lack of personnel interest.

In selecting the furnishings for wash and locker rooms, a tabulation was prepared of various possible types of equipment and, through the operating department, employees were canvassed to determine their choice. The equipment selected was that preferred by a majority.

Fresh Air Supply

Another item given considerable thought was the provision of fresh air and cooling facilities to various locations where men were either constantly or frequently stationed. In the administration building, in locker and wash rooms and in other inclosed work areas, arrangements are made for supplying clean fresh air from outside sources. In cold weather the air is to be tempered by heating coils. In warm weather the air to the office and operating room will be cooled by mechanical refrigeration. In locations in the boiler house, as for instance at the boiler control boards, fresh air will be brought from cooler locations in the boiler room during the winter period and in the summer time the air will come from outside the building. It will always be so tempered that it will be comfortable for the men stationed in that vicinity. Additional provisions are made to supply fresh air to boiler house areas which are ordinarily quite hot and difficult to cool by natural air circulation.

Keeping in mind that the building is constructed with glass block panels instead of windows for lighting, it was necessary that particular provisions be made for admitting air for boiler combustion. For this purpose openings with dampered louvers are provided in the lower area of the boiler house, with similar louvered openings in the upper portion immediately below the fan floor and above the top of the boiler. In the winter time the air can be taken from the upper level and swept across the hot upper portion of the boiler room where normally no operating personnel will be working, then through grating areas in the floor and to the forced-draft fans. In the summer periods the dampered areas in the lower part of the boiler house will be opened to bring in the outside air and the upper dampered areas will be closed.

Engineering, preparation of plans and purchase of all apparatus and equipment have been carried out by Philadelphia Electric Co. The construction is being done by United Engineers and Constructors, Inc., under the general supervision of the company's engineering department.

CENTRAL MAINE POWER

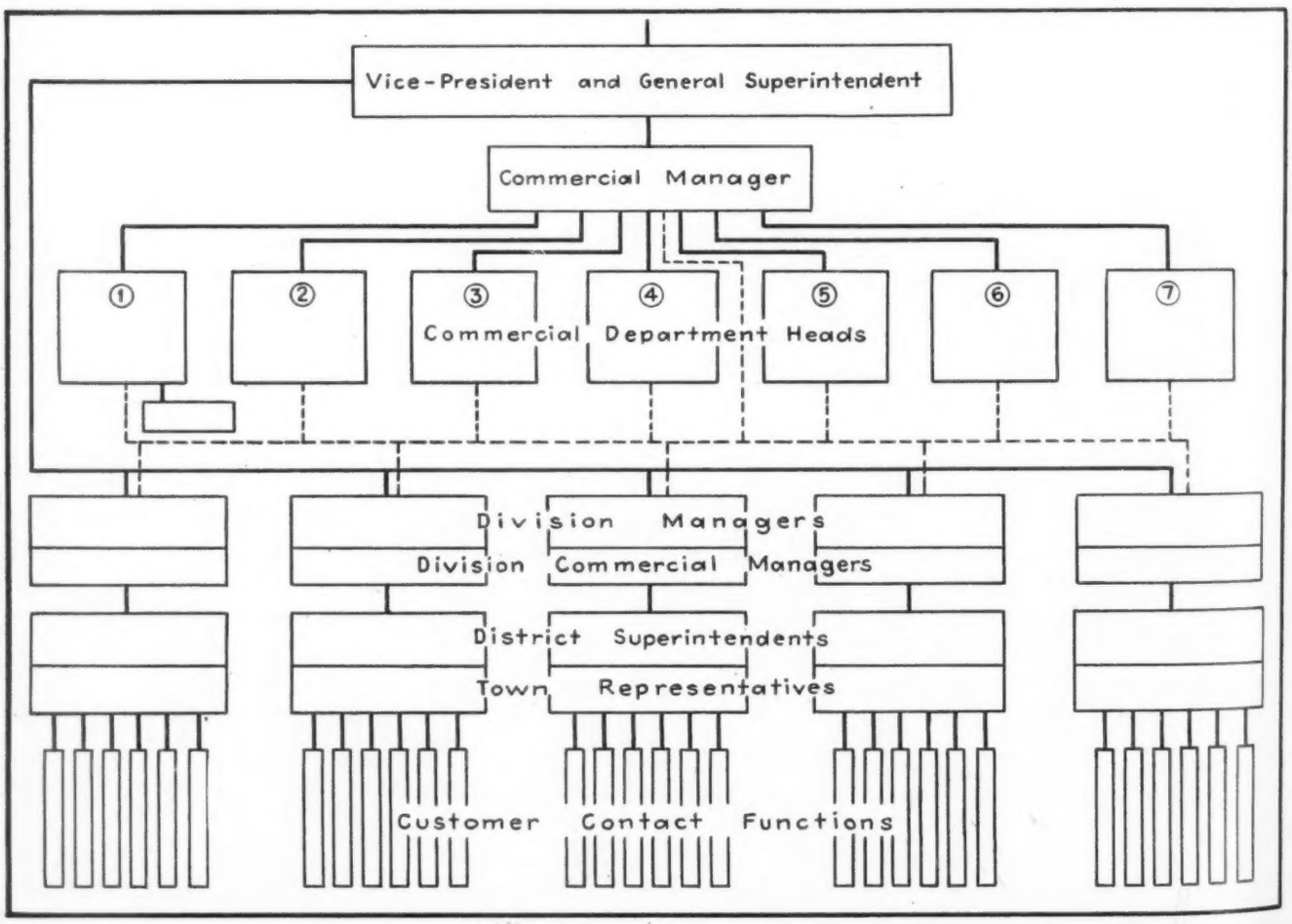
Defines Post-War

BELIEVING that every employee's job is to sell electricity, Central Maine Power Co. defines the commercial department's function as the cooperative promotion of all phases of load building. Formerly the "New Business" department, the present set-up is more inclusive, covering load building, servicing, dealer contacts, power sales, merchandising, home service, rural extensions, lighting promotion and personnel, all under centralized control.

Departmental Organization

The company serves a wide area, operates 36 stores and has a total sales and service personnel of over 150. Policies necessarily originate from a single source, to be interpreted in the field with reason, seeking to render identical and satisfactory service to 165,000 customers. At Augusta headquarters is a general commercial manager heading the department. Divisional managers in the field, both territorial and commercial, function as shown on the chart. Headquarters specialists aid field forces through the established divisional set-up. Technical staff heads work closely with field men.

ORGANIZATION CHART of commercial department of Central Maine Power Co., showing relations between executive and staff personnel. Solid lines indicate direct authority and dashed lines advisory responsibility. Customer contact functions cover sales and service of residential and heavy duty appliances, lighting, home and industrial service



Load-Building Policies

Commercial organization encourages vigorous sales activity—General office specialists work with field staffs—Dealer relations vital

Local merchandising and advertising activities are given opportunity for considerable latitude in administration. So-called interdepartments are eliminated in this set-up. Coordination of all load-building work is achieved by the commercial department under the organization illustrated.

Accelerating Load Building

The general office objective is to aid divisional personnel in load building. Freedom of consultation and frequent trips of headquarters men in company with local staff members are encouraged. Staff specialists know the latest ideas and improvements in their fields, and a free exchange of ideas between staff and field men speeds up load increases and indirectly strengthens customer relations. In general, main office staff members work with divisional personnel rather than directly with customers and prospects, but in all cases complete interchange of information and ideas is sought. On occasion, of course, customer contacts include both specialists from headquarters and field men.

Divisional Sales Set-Up

Sales plans and policies outlined by the commercial manager clear through divisional managers as liaison officers to division commercial managers responsible for their execution. These include merchandising, power, lighting, farm and servicing. Each larger company store has a full-time manager. Store operations and supervision over company salesmen working out of these centers are under him. In smaller stores a combination storeman-salesman is provided. Because of the area covered by a division commercial manager and also to maintain closer commercial functioning, the direct supervision of storemen, salesmen and other load-building personnel and activities in each respective town is vested in a district superintendent, district agent, town representative or town agent as required. The division commercial manager has general direction over these local men. The sales and load-building program is a direct responsibility of division and district heads like any other company function, in carrying out plans and policies enunciated by the general office and with the advice of its personnel.

Functions of Commercial Department Heads

(1) Director of advertising and sales promotion.

Preparation of newspaper advertising, campaign mailing pieces, sales promotion copy for internal use (advertising agency retained for consultation and advice); pre-release of advertisements to division personnel for comment; handling solicitations for local advertising (all to be forwarded to general office); store and window displays, exhibits, scheduling and inspection of window trims. Decisions on local advertising are internal matters, with considerable discretion lodged in the field. Uniform and scheduled activities are favored when feasible. Publicity as to company policies is released through Augusta checking.

(2) Director of appliance service.

Efforts to improve and standardize service operations, control of parts stocks, kinds, vendor selection, etc. Practices and policies on appliance repair and servicing; investigation and solution of service problems. Regular contacts with district and division offices.

(3) Director of farm service.

Training local farm sales personnel. Direct contacts with granges, etc., with hardware and farm implement dealers, and electrical contractors. Cooperation with farm extension service, 4-H clubs, county agents, contacts with manufacturers selling farm specialty equipment; promotional work including pushing appliances not merchandised by the power company, and cooperation with the plant department to help bring full benefit to farm customers from extension developments and maximum opportunities for expanding electric service in the rural field.

(4) Coordinator of home service.

Objectives are to create homemaker's desire to own electrical equipment of standard quality, better home lighting, larger use of home appliances and appreciation of rates encouraging such use, better customer relations. Broadly unified policies stemming or approved from headquarters, but local divisions are free to take on special activities after checking with Augusta to insure adherence to same general policy. To prevent indiscriminate commercialization of home service work or cooking schools, no division can subscribe to any service or cooperate with such a commercial program without first checking with the home service coordinator. Home service employees cooperate with dealer sales. Early calls after installation of ranges, dishwashers, and garbage units are scheduled.

Demonstrations before school groups are very important, as are public explanation of the use and care of equipment.

(5) Director of industrial division.

Handles power sales activities, assisting local areas. Rates, load-factor studies, contracts, complaints, installation problems (working with transmission and distribution departments), economic analyses, industrial electric heating and motor applications, meeting competition of isolated plants, general engineering aid, consultations with architects, layout suggestions, regular calls on power customers, and cooperation with division power engineers.

(6) Director of lighting division.

Promotion of sale and use of adequate illumination by all types of customers, with layouts. Sale of electric lighting equipment in general by trade outlets. Assistance of divisional personnel in rate surveys, contract solicitation, consultation with architects, engineers, contractors, dealers and factory outlets. Direct supervision over company's marketing of lamp bulbs.

(7) Sales supervisor.

General office contact man for coordinating sales activities, works as a "free lance" staff representative to aid any field man in the company's best interests. Interprets company policies. Responsible for a general sales training program, and activities relating to all branches of load building.

Commercial Price Policies

Prices, terms, discounts and allowances are fixed and uniform in all divisions to protect the purchaser, safeguard the company's profits, establish and maintain confidence in the public mind. Major cooking or refrigeration units used in schools or for demonstrations will be sold at list less 25 percent. When the market opens up, the company's policy of a three-year guaranteed replacement will be resumed. All applications for equipment for school service must be reported to the commercial manager. A 15 percent discount applies on equipment sold to schools (not regularly using this for domestic science or demonstrations), to county agents and 4-H Club demonstrators (for their personal use), and to apartment house owners and builders.

To stimulate full electric use, a 5 percent discount is allowed on three or more major appliances purchased at one time, and 10 percent if the sale is $750 or over. On cooking and heating appliances (total sale $1,000 and up) a 5 percent quantity discount is available as an optional allowance in lieu of the regular wiring allowance. This applies only to electrical equipment in connection with heavy duty refrigeration apparatus. List less 25 percent is granted employees buying appliances for their own use or bona fide gifts. No appliance may be bought by an employee for resale. Used appliances owned by employees must be disposed of through the company's regular sales channels. Fifteen percent off list is billed to employees for repair parts.

Dealer Relations

The company encourages dealers in handling their own lines of merchandise. It has eliminated the former dealer discount on appliances, but will lend lamps subject to their equivalent replacement in case of shortages faced by contractors and dealers. Every effort short of subsidy is undertaken to encourage healthy dealer cooperation and sales. This includes extensive cooperation in promotion. More cooperative reporting of major sales by dealers is a company objective, to aid the sales program and system planning. Home service department cooperation is available to any dealer. Dealers are encouraged to establish and maintain efficient servicing facilities. Company servicing facilities are liberally handled as to cooperation. Independent financing by dealers of their sales is favored.

The company will confine its sales of commercial refrigeration equipment to so-called packaged merchandise and sales of condensing units up to 1 hp. for any single unit and up to 3 hp. with the approval of the commercial manager. This is done to build up sales of large commercial equipment like air conditioning by dealers who are in a better position to sell and install such equipment. Full engineering and sales assistance will be extended to any such dealer, covering air conditioning and cold storage requiring over 3-hp. units, locker equipment, and similar apparatus.

Comprehensive plans are included in the improved departmental set-up for defining home service department activities, protection of salesmen in connection with prospects, selection and purchase of small appliances, portable lamps, establishment of quotas for the company's territory, details of compensating salespeople, handling deliveries, bonuses to domestic salesmen for commercial loads, encouragement of wholesalers and distributors in visiting company stores and offices, and training salespeople. Special studies are under way in connection with the problem of overcoming wiring costs as obstacles to wider sales, and "trade-in" matters have been considered at length, the fundamental objective being to see to it that the company concentrates on the sale of high-grade equipment and material, and that trade-ins are not allowed to impair this policy.

Quality Merchandise

Except for general stocking or campaign periods, the requisitioning of small appliances will be left largely to the discretion of the individual company store, through the division commercial manager, once the "line" is established and approved by the general office. Most major appliances will be purchased by the latter in close check with division and district stores as to models, price ranges, etc. Any store manager may suggest adding new lines at any time, but commitments are the province of the commercial manager. The general policy is to feature as low-priced quality merchandise as any reputable store including "chains," but no attempt will ever be made to sacrifice quality, service, and satisfaction for price.

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Electric Condensation of Cooling Tower Mist

Experiments have been carried out at the Bradford (England) municipal electric plant to determine the practicability of using electrostatic precipitation of vapor from the city's water cooling tower. According to the *Electrical Review* Manager T. H. Carr has been using 40-kv. testing apparatus and has been getting promising results. It is expected that about 90 percent of the mist could be retrieved. Not only would this reduce the $50,000 annual water bill in generating 300 million kw.-hr. but it would also avoid creating ice hazards on adjoining roads in the winter.

TREND PREDICTION Important in Planning

HOWARD P. SEELYE*, *Senior Engineer, Engineering Division, The Detroit Edison Co., Detroit, Mich.*

Careful prediction of long-range trends is of the greatest importance in determining future growth—Urges realism in estimating new developments—Potential demand proposed as basis for growth curve

LOAD GROWTH estimates made from detailed studies of components in the use of electric power probably give as accurate a picture as can be obtained for a few years ahead, serving as a basis for immediate expenditures. It is equally important that some guide be obtained for directing the thinking on policies and plans for a longer period in the future, and these detailed estimates become less dependable as the period is extended. Another method must therefore be sought for the long term trend.

The most common method of estimating the future trend of any variable quantity is to plot its past history on a curve and by laying a straight edge between some two selected points, attempt to extrapolate it into the years to come. This crude method is, of course, not likely to give very good results, particularly with the erratic behavior of most of our system load curves. On the other hand, a careful study of these curves may show trends which will be of considerable help in establishing a pattern for the future.

There are a great many possible trends which might be derived from them, depending on the points chosen and the assumptions made. These include straight lines of various slopes, and curves with upward and downward curvature. In our case a curve with a continuous increase of 20 percent per year fits very closely the first 20 years of the company's life. A similar curve at a rate of about 13 percent could be derived from the later history by omitting all depressions. Such a curve applied to the future, however, gives results which seem improbable.

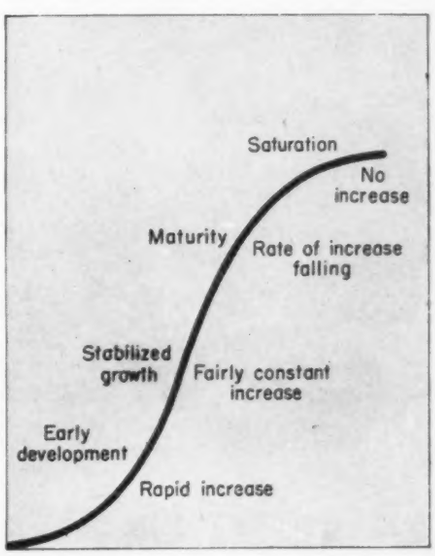
Typical Growth Curve

What appears to be a somewhat more logical pattern can be obtained by applying the well known curve of growth which is typical of the life history of many things—population, production of certain industries, growth of living things, etc. Such a curve is shown in Fig. 1. It is characterized by a rapidly increasing slope in the early stages, a steady and still rapid growth as the size increases, a point of inflection where the curvature reverses, a period of maturity with appreciable growth but at a decreasing rate, and an eventual convergence on saturation with no further growth.

It seems logical to assume that eventually, and in the broadest sense, the growth of the electric power industry and of each unit which comprises it will follow some such general trend. If this assumption is tenable, it remains to be seen how it can be applied to the known facts regarding any specific power system load. The big question is—"Where are we now on the curve?" In most cases the future will, no doubt, show a rising load curve, but will it follow a rapid upward sweep such as that of the lower part of the typical growth curve, a straight line such as is characteristic of the middle part, or a decreasing slope similar to the upper portion? If any logical evidence of this characteristic can be discovered, it should be most helpful in long-range planning for system capacity.

The load curves of most companies during the past 25 years have been so irregular that no direct application of the typical growth curve to the trend of the yearly peaks seems possible. The effects of the major depression following 1929 and the recent war period, in particular, and other lesser disturbances have resulted in a very ragged curve. Economic conditions have been relatively unstable throughout this period and the variations in those conditions have had a close and immediate effect on the power peaks. The curve of the Detroit Edison load in Fig. 2

FIG. 1—Typical curve of growth



* Based on a paper presented at the Midwest Power Conference, April 3, 1946.

illustrates this. The variations in that system have probably been as great as anywhere in the country.

Potential Demand

It is possible, however, to conceive of the "potential demand" of a system as a factor which is of a more regular character than the actual peak load, and to which the growth curve will be more applicable. The desires of a community for electric power are built up by past use, by new inventions and improvements in equipment, by advertising and other sales efforts, by normal growth in population and by familiarity with and appreciation of the advantages in electrical applications. When economic conditions are bad, industrial production low and money scarce, these desires for electric power continue even though they cannot be satisfied.

The potential use of power was as great in 1933 as it was in 1929. Not only do the desires continue but they no doubt continue to increase, even though the increase may be somewhat retarded by the business conditions. When business recovers, the actual use of power rises toward the point of satisfying the full existing "potential demand." This point may not be reached before another economic disturbance sets in, as in 1936, but at all times the load is approaching the "potential demand" as closely as general economic conditions will permit.

An Application of Curve

This conception of "potential demand" has the quality of consistency which will allow a reasonable application of the typical curve of growth. Referring to the Detroit curve, Fig. 2, the lower part up to 1929 is quite regular and similar to the typical curve. From 1929 on, although the load fell away greatly, the "potential demand" may be thought of as continuing to rise along a curve of the shape of the typical curve.

In order to get any indication of the proper location and shape of this extended curve, at least one other logical point on it must be sought. The economic conditions during the period between 1936 and 1940 were such that full satisfaction of "potential demand" was not conceivable at any time. It seems likely, however, that the load reached in 1943, even though it was under the most abnormal conditions of war production, would be a reasonable conception of what the civilian demand might have been at that time under a high degree of prosperity.

Mr. Constantine Barry, in an article entitled "Post-War Load on Electric Utility Systems" (ELECTRICAL WORLD, January 8, 1944), has estimated that the 1943 peak on a national basis was 14 percent above what it might have been expected from civilian load without the war. The assumption that the civilian load would have equalled the 1943 load is, therefore, on the high side of this estimate. Admittedly this is guessing, but whether the point is taken at the 1943 peak or at some other logical point is immaterial to our theory.

Future Trend

The curve for assumed growth may be drawn through any point which seems most reasonable to the individual

FIG. 2—Typical curve of "potential demand" growth applied to the Detroit Edison Co. load

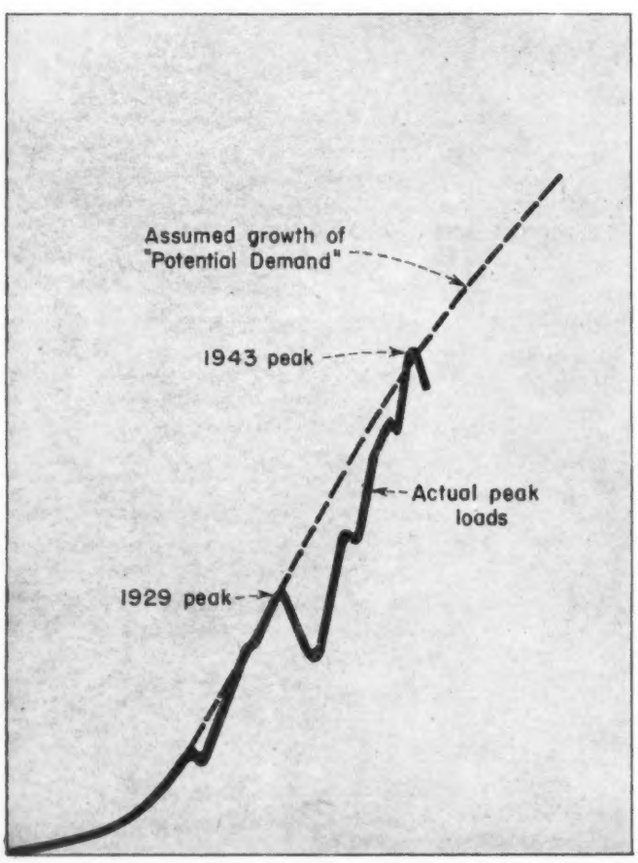
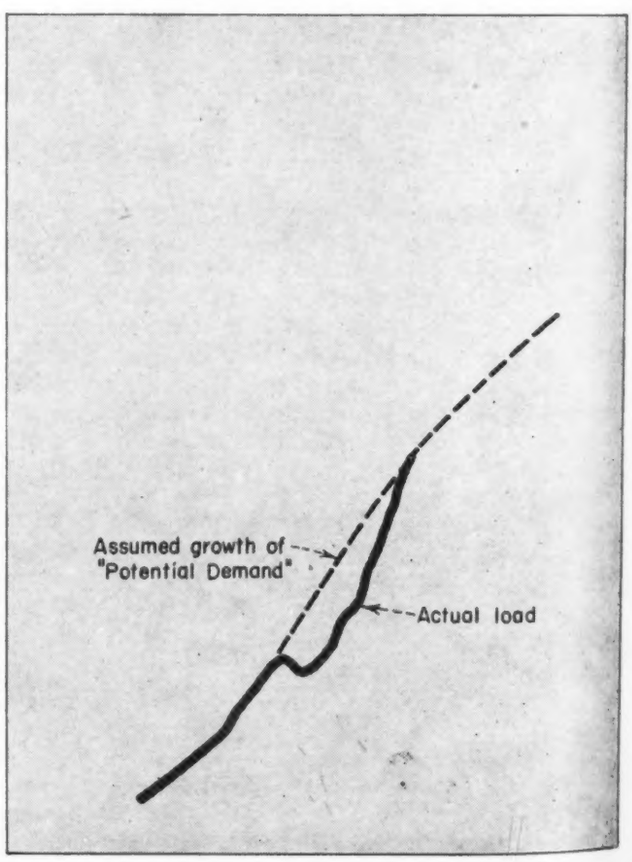


FIG. 3—Typical curve of growth applied to total power load of the United States



drawing it and the exact shape is also subject to individual variations. On Fig. 2 a growth curve has been drawn which seems reasonable for the points chosen and for future general probabilities.

This curve may be thought of as an *envelope* of the peaks which may be reached by the load as time goes on. There will, of course, be periodic valleys and peaks as economic conditions vary from year to year, just as there have been in the past. The curve for the past has, however, represented an envelope of the load peaks through the many vicissitudes of 45 years; similarly, the extended curve should allow for the vicissitudes which will surely come in the future. Since it represents "potential demand" it indicates at all times the heights to which the load is attempting to rise even though it may seldom actually reach it. Consequently, it also should represent the maximum system capacity which need be provided at any time to carry that load.

Trend for United States

As a matter of further interest, the total power load of the United States, as given in the Report of the Commercial Planning Committee, Edison Electric Institute, September, 1944, is plotted in Fig. 3. It is evident that a growth curve can be applied to this which is quite similar to that used in Fig. 2.

It is not intended to imply that the particular application of the growth curve which has been shown is characteristic of all systems or of their component parts. Some of these may have reached quite different points on the characteristic curves. For example, the load in some rural territory may be in the early stages of development and expect a rapid upswing. On some there will be prospect of large growth in population or large new industries which will greatly affect future loads. On the other hand, in some areas the approach to saturation may be not far away.

Each such case must be studied in the light of its own history and possibilities, but the conception of the typical growth pattern should be helpful. A periodic revision is necessary, of course, to take account of changing conditions as they develop, since no long-range picture of the future can be expected to materialize exactly. The essential point is to recognize the value of long-range planning and to provide as sound a basis as possible for that planning.

Approach to Maturity Justified

The curve shown in Fig. 3 might be questioned as not being sufficiently optimistic and based on too scanty evidence. It must be acknowledged that the 1943 load point alone is not a very firm basis for a future forecast. There is, however, additional evidence which tends to indicate that in general, an approach to maturity is not an unreasonable assumption. In our own case, the curve agrees well with the detailed estimates for the next ten years. Careful studies of the various possibilities of load development conclude that, for many of the uses, the additions to system peak load would not be in proportion to their consumptions of kilowatt-hours.

In fact, it should be one of the prime objectives of load building to increase the load factor of the system, making as great use as possible of the investment in generators and in the distribution system. Therein lies the greatest remaining possibility now available for reducing the cost of electric power. It may be expected, therefore, that the kilowatt demand on a system will approach maturity even somewhat sooner than will the energy production. It also should be recognized that, in well developed areas, the easy load has been taken—lighting, substitution of electric power for mechanical power, the simple and common household appliances, etc. In the future, increased load must be gained against stiffer competition for the consumer's dollar.

Contributing Factors

Use of the typical growth curve and potential demand approach does not preclude use of the well recognized method of estimating consumption in each of the general classes. Rather, it is a means of gaining an over-all viewpoint to check detail conversion of kilowatt-hour consumption into system peak load. Such estimates, obtained either by applying system load factors to the grand total or by deriving the peak responsibility of each class, are widely used. Difficulties arise, however, when we consider the details of individual applications of electric power.

Many new applications of electric power in the home and considerable increases in the old ones are foreseen. Some very extravagant claims have at times been made as to the probable amount of energy consumption which will result. Increased lighting, electric ranges, deep-freeze units, air conditioning, television, electric blankets, water heating and house heating are most often mentioned. A critical examination of the characteristics of these applications is essential to a realistic consideration of fact and probabilities.

Greatly increased lighting may be expected but the use of fluorescent lamps will tend to modify the resulting increase in load. Air conditioning will be a major factor of increase, but this load is not on the present winter system peak on our northern systems. The heat pump has possibilities in this field for combined heating and cooling. Such a load would probably be a direct addition to system peak. Here, again, competition of other fuels will be a restraining factor in the growth of such load.

Industrial Load

Industry in general has been pretty well electrified as to motor power. Strong competition in the heating field may be expected from other fuels. The trend toward shorter daily working hours for labor may well continue. These factors will tend to counteract a rapid growth of industrial load. Naturally, in any area there is always the possibility of the addition or loss of a very large load due to a single industry or plant and such loads have an appreciable effect on the system capacity needed. In the Detroit area, the automobile industry is the largest single element and the future industrial load on the electric lines depends to a great extent on the future output of that industry.

It must not be inferred that in talking of approaching maturity there is any intention to indicate that saturation, with no growth, is near. On the contrary, the industry is still relatively young and its future prospects are bright. Substantial increases both in kilowatt-hours and kilowatts are to be expected. The purpose here has been to point out, along with these prospects, certain realistic factors which will influence the rate of growth and to offer a logical method for projecting a broad and long-range pattern for the future.

BURIED CABLE FAULTS

Located by Sonic Detector

F. S. BENSON, G. L. HILL and C. R. MACHEN*, *Pacific Gas and Electric Co., San Francisco, Calif.*

Crystal vibration detector used in place of microphone on sound level meter together with impulse generator combine to provide simple, reliable method of locating faults in both shielded and unshielded cables

LIMITATIONS of all currently used systems of locating faults in underground cables, particularly non-shielded buried cables, led engineers of Pacific Gas and Electric Co. to make a thorough study of the whole problem of cable fault detection. This study included various inductive pick-up coils, bridge schemes, resistance measurements and the Varley and Murray loop methods. After laboratory experimenting and field trials covering a period of years it was decided that a combination of two test methods offered the most satisfactory and economical means of locating faults in buried non-metallic sheath power cables of relatively low resistance and of lengths of a few hundred or thousand feet to several miles.

Non-Metallic Problem

In recent years the company has made several installations of buried non-metallic sheath cables which have given a very good account of themselves, but the depth of the cables below ground made accurate fault location impossible with the testing equipment that was available. Commercial inductive pick-up type of cable fault locating devices work satisfactorily in giving an indication for locating short circuits occurring on lead-covered cables. They use electromagnetic or electrostatic fields for successful operation. When fault resistances are low and the ground return is positive, these tests are successful, but rubber - insulated, rubber - jacketed cables may have fault resistances varying from a few thousand to 100,000 ohms; also, the ground return circuit is not direct as no metallic sheath is used. Existing test devices therefore did not give a reliable location of the fault.

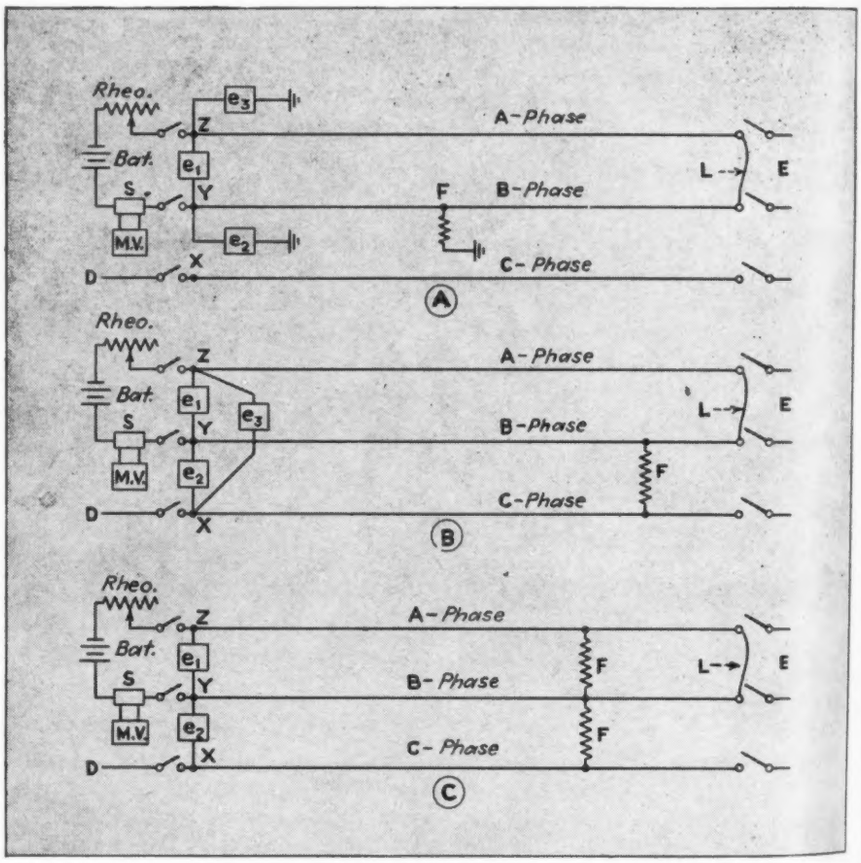


FIG. 1—Wiring diagrams of resistance method for approximate locating of cable faults, (A) grounded fault, (B) and (C) ungrounded faults

The engineering department was requested to design a fault locating device which would give positive fault location for such buried cables. A review of the literature on this subject indicated many types to choose from, but tests made with them were unsuccessful. An E.E.I. report of a meeting held in May, 1939, published a paper by the Detroit Edison Co. giving the development of a sonic type fault detector for their cable system using a stethoscope or an audio-frequency

* Assistant engineer, engineering dept.; Bureau of Tests; and superintendent, electric lines, East Bay division, respectively.

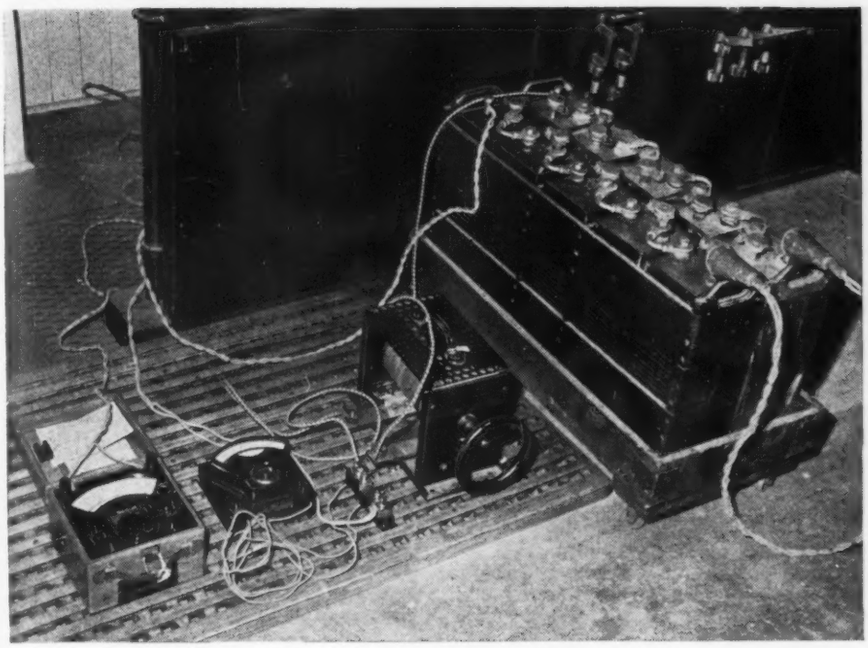


FIG. 2—Instrument setup for resistance measurements of circuits in Fig. 1. Equipment needed: potentiometer type voltmeter, millivoltmeter and shunt, rheostat and battery connected for a test

amplifier together with head phones to determine the location of a cable fault by the noise energy produced by the arc. Upon request Detroit Edison furnished more information. They stated that the device was successful for locating faults in lead-covered cables and buried cable in dry earth, but had no data on cables buried in wet or swampy locations.

Experimental Model

After conferences with the East Bay division, it was decided to build an experimental model of the sonic fault detector and conduct a series of tests. The Bureau of Tests built an impulse wave generator, using two 5,000-volt tubes in series, to produce 10,000 volts. A condenser of 12-microfarad capacity connected to a 12-kv. distribution transformer formed the circuit for the impulse wave generator. An adjustable sphere gap discharged the condenser at the proper voltage. A sound level meter with a vibration pick-up substituted for the microphone was used as the sonic detector.

About 100 ft. of cable was buried in the laboratory yard. Tests showed that when fault resistance was moderately high, the energy of the arc produced a sound wave in the earth surrounding the arc which could be readily amplified and located by the sound level meter. However, when the area around the faulted end of the cable was saturated with water approaching a mud condition, the sound wave generated was quite feeble and the sound level meter required considerable amplification to locate the arc. The tests showed further that the sound wave generated by an arc attenuates very rapidly and could be heard for only about 20 ft. from the arc. When it was attempted to use the impulse generator and the vibration pick-up without first testing and calculating the position of the fault, it was like hunting for the proverbial "needle in the haystack." Therefore, it was determined that a successful cable fault locating device must consist of two pieces of equipment: (1) a resistance measuring device to determine approximate location of the fault, and (2) a sonic fault detector to survey carefully the approximate location so found to determine the *exact* location of the fault.

Fault Locating Procedure

The two methods essentially are:

1. Locating the approximate position by d.c. resistance measurements.

2. Locating the exact position by applying an electric impulse to the cable and, by means of a crystal vibration pick-up and electronic sound amplifier, locating the exact position of the fault before any digging or cutting operations are performed.

The resistance measurement method which has been used very successfully in locating the approximate position of grounded cable faults is shown in Fig. 1. Fault position may be determined to within ½ of 1 percent of the total length and generally may be calculated to a higher degree of accuracy when the length of the cable may be obtained from available maps or measurements. Referring to the diagram of Fig. 1a, the grounded bad phase "B" is tied at station "E" to the good phase "A" with a low resistance jumper loop "L." A battery is connected to the "A" and "B" phases at station "D" forming a loop. This battery should be capable of supplying current up to 100 amp. at 10 to 20 volts, with a suitable rheostat to hold the current at a steady value while readings are taken. A *potentiometer* type voltmeter is used to obtain readings of voltage, that is, e_1 from Y to Z, e_2 from Y to ground and e_3 from Z to ground while the current is held at the same value by reading the millivolts on the shunt S.

Proportional Readings

The current should be adjusted so that a reading of 100 divisions is obtained on the voltmeter regardless of what voltage is applied, when connected to Y and Z. The voltage readings from Y to ground and Z to ground should add up to 100 or 100 percent. The reading, e_3, obtained from Z to ground will give the distance in percent of cable length from the point Z to the fault at F. Likewise, the reading e_2 obtained from Y to ground will give the distance in percent of cable length from the point Y to F.

Correction for the resistance of the jumper L in equivalent footage of cable must be made if it is an appreciable percentage of the total resistance. It is obvious that any appreciable resistance at the fault F to ground will introduce an error in the readings if an ordinary d.c. voltmeter is used. To overcome this a *special potentiometer voltmeter* must be used and experience has shown that in order to obtain accurate results it is essential that an instrument of this type be employed for the test.

Corrections must be made for small potentials due to railway currents or extraneous ground currents in some locations. In order to determine what these potentials are, the battery is disconnected and readings are taken from

Y to ground and Z to ground. The polarity of these readings should be carefully noted so that correction is made in the proper order. A quick acting reversing switch may be used in the battery supply and potential circuit if it is desired, to correct for the potentials interposed by an extraneous ground current while the readings are taken.

Fig. 1b shows this method being used to locate an ungrounded fault F between B and C phases. The battery circuit is completed by using the good phase A and one bad phase B. The C phase is then used as a potential wire to the point F and readings are taken from Y to X and Z to X giving potentials e_2 and e_3 which are expressed as a percentage of e_1.

A fault between three phases (not grounded), may be located as shown in Fig. 1c. In this case one phase is also used as the potential wire to reach the point F. A reading, e_2, expressed as a percentage of e_1 will give the location of F. A picture of the assembled resistance measuring apparatus is shown as Fig. 2.

Impulse Generator

After the approximate position of the fault is located by calculations from d.c. measurements, the impulse generator is connected to the faulted cable. The impulse generator is essentially an assembly of a potential transformer, a capacitor, a rectifier tube for charging the capacitor, and a discharge gap to hold the charge on the capacitor until the desired voltage is reached. After the voltage has been increased to a value that jumps the gap, the discharge impulse from the capacitor travels along the conductor to the fault, passes through the fault to the earth and returns to the generator. Considerable energy is dissipated as the impulse current passes through the fault. This gives off a vibration that can be detected with a crystal vibration pick-up through a suitable sound amplifier. Under favorable conditions the sound is audible without an amplifier and may be heard if the fault is near the top of the ground, or if the fault is in a duct it may be audible in a manhole.

Sound Level Stethoscope

Fig. 3 is the wiring diagram of the impulse generator and Fig. 5 is a picture of the equipment in the corridor of a switch house where it is connected

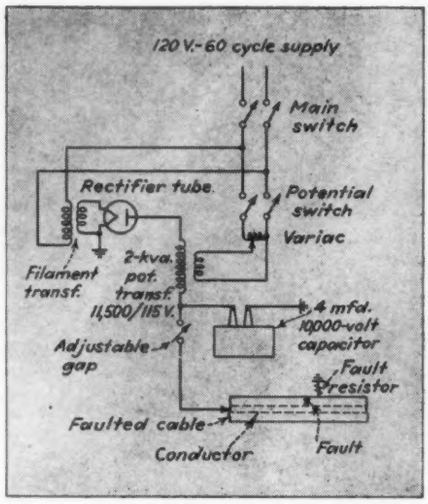


FIG. 3—Wiring diagram for impulse generator and connection to cable

to a suitable 60-cycle, 120-volt supply and the high-voltage side to the faulted cable. A sound level meter with a crystal vibration pick-up substituted for the microphone has been found most satisfactory in locating the exact position of the fault. It has all the necessary essentials, such as amplifier output meter, jack for head phones, plus the decibel scale on the gain dial of the amplifier and output meter. This is very helpful in locating cable faults when using the vibration pick-up. Fig. 4 shows an operator making a survey to locate a fault in a buried nonmetallic sheath cable. Readings are taken in steps of 10 to 15 ft. with the vibration pick-up placed on the ground as shown.

An experienced operator can easily follow a buried cable by listening to the induced voltage in the head phone leads with the amplifier turned off. This determines the position of the cable during the survey. The vibration pick-up is placed on the ground, from position to position, and the amplifier is used to amplify any mechanical vibrations picked up. The operator has no difficulty in identifying the discharge sound of the impulse in the ground when he locates the fault position. Maximum decibel reading gives him the exact spot and he can instruct the repair crew where to dig for the fault.

Field Experience

Approximately two years' field experience with the impulse generator has demonstrated its practicability for locating cable faults on both leaded and non-leaded cables. It has been

FIG. 4—Earth shocks from arc discharge at cable fault are picked up by crystal vibration detector (on ground at right) and amplified on sound level meter

particularly valuable for use on buried cables. Induction type fault finders have not proven satisfactory in many cases because of the "carry-over" of the signal past the fault. Such carry over of the signal does not occur with the impulse generator. Much time and money was formerly spent in locating faults on buried cables by the cut and try method, since other types of fault finders failed to locate the fault. The device as constructed is easily handled in the field by any cable truck equipped with a crane for handling transformers, etc. It can be set up in substations, over manholes, adjacent to riser poles or where need be. Where 120 volts a.c. is not available, a small gas-engine-driven, 120-volt generator can be used for energizing the set.

The controls are simple and the operation of the set has been found to present no difficulties to field personnel. The safety features of the set have proven satisfactory. A knowledge of Ohm's law and the ability to make simple calculations is all that is necessary to use the resistance method for determining approximate fault location. Where the cable run in trouble is short, the resistance apparatus described is not required. However, with runs over 300 or 400 ft., time is saved by using the resistance method to obtain an approximate location of the fault because of the selectivity.

Selectivity

The impulse picked up by the sound level meter has been found to be quite selective, the selectivity varying with the depth of the cable. On cables buried 2 to 3 ft. deep the impulse will not be audible until the pick-up is within 4 or 5 ft. of the fault. On cables buried 10 to 12 ft. deep, the signal can be heard within 10 to 15 ft. of the fault, the intensity increasing as the fault is approached.

The sound level meter will pick up the signal by induction, but this is not confusing after a service man has once used it. It is only necessary to increase the gain control and if the signal does not increase in intensity, it is caused by induction, whereas the vibration or audio signal will increase in intensity as the gain control is increased. This signal, of course, is what is desired.

Experience has shown that a discharge period of one or two per second is easy to pick up in the field and the adjustments are made for this rate. It is seldom necessary to use the maximum output of 10,000 volts.

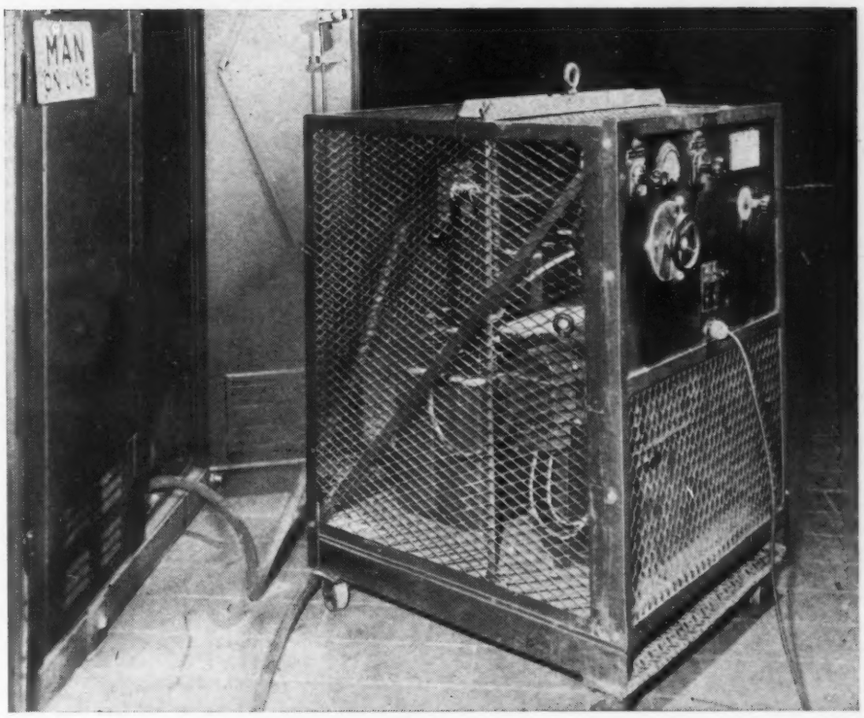


FIG. 5—Portable impulse generator connected to faulted cable sends out impulses at variable voltage up to 10,000 at rate of one or two per second

The following examples are actual cases where the fault detector set was used to locate a fault when other methods had failed:

1. A 12,000-volt tie cable approximately 23,000 circuit-ft. long consisting of three 750,000-cir. mil, 15,000-volt, one-conductor cables failed. A portion of this circuit consists of lead and paper cable in ducts: approximately 3,000 ft. of non-leaded, shielded cable, buried directly in the ground from 5 to 12 ft. deep, some of which is under railroad tracks and concrete warehouses. The balance of the circuit is non-leaded, shielded cable, pulled in ducts. The resistance apparatus indicated that the fault was in the buried section near a concrete warehouse. The impulse generator was connected up at the station and readings taken on the sound level meter at intervals of 5 ft., starting 100 ft. from the warehouse. Maximum reading occurred at the corner of the warehouse and subsequent excavation verified the readings of the meter. The cable at this location was 12 ft. deep.

2. Another fault occurred on this same circuit, the resistance apparatus indicating the fault to be in the lead and paper section. Men were stationed in the manhole at each end of the section indicated and the impulse generator started at the station. The sound of the discharge could be heard in the manhole closest to the fault, it not being necessary to use the sound level meter in this case.

3. A 4,500-volt, three-conductor, non-leaded, non-shielded cable buried directly in the ground in the sidewalk area of a residential district failed and the fault could not be located with the usual induction devices. Since the run is only about 300 ft. the resistance apparatus was not used. The impulse generator was connected to the cable at the manhole and readings taken on the sound level meter at intervals of from 3 to 5 ft. The fault was located approximately 200 ft. from the manhole directly under the point of maximum sound on the sound level meter.

4. A 15,000-volt, three-conductor, non-leaded submarine cable operating at 4,800 volts and buried directly in the ground failed and the fault could not be found with the induction devices. Because of the 15,000-volt rubber insulation on the cable and dry ground, the fault resistance was quite high and it was necessary to adjust the impulse generator for maximum voltage to obtain a satisfactory discharge. The fault was located directly under the point of maximum sound on the sound level meter.

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Evaluation Of Restriking Voltages

From a paper by J. R. Mortlock, in the "Journal of the Institution of Electrical Engineers" (British), December, 1945.

GREATER ACCURACY in evaluation of restriking voltages, or those voltages which exist at or close to each zero current pause during the arcing time associated with current interruption, is obtained in a method of calculation discussed, largely because of fewer approximations than are required in the method of Boehne in papers before the A.I.E.E. The assessment is carried out in three steps: (1) substitutions of equivalent circuits for cables, overhead lines and apparatus; (2) combinations of these equivalent circuits to represent the desired interruption condition, and simplification to one or more of the standard circuits tabulated; (3) solution of the final circuit from this tabulation.

The solution involves reduction of the system to include only the fault current supply channels and the particular circuit being investigated. Sometimes channels which contribute only a small part of the fault current may be neglected, as their presence may reduce the rate of rise of the restriking voltage, which is out of proportion to their contribution to the current to be interrupted. With such modifications the circuit may be put into one of the eleven basic circuits in the tabulation for which equations have been worked out. Substitution of values in these equations will then give the solution without the need for the intermediate calculations.

Salad Crops Give Off-Peak Load

From an article by A. D. Johnson in "Electrical Review," London, December 28, 1945.

USE OF ELECTRICITY for growing lettuce and similar crops in hotbeds is possible in cold weather to serve a quality market. A standard frame 6 x 4 ft. is heated with a resistance cable. Energy consumption is around 90 kw.-hr. for the three months of growth, which is at the rate of 3 d. (6 c.) per head.

The standard cable is in 25-ft. length, taking 125 watts, and is sufficient for an 8 x 6 ft. frame. It is laid about 6 in. below the final soil surface, the parallel portions being about 7 in. apart. A thermostat is considered unnecessary, as the heater can be turned on at night and at other times as needed. After being placed the cable can remain for at least five years.

By planting carrots between the lettuces a second crop can be harvested, increasing the revenue possible with the installation.

Silicon Carbide Non-Ohmic Resistors

From a paper by F. Ashworth, W. Needham, and R. W. Sillars before the Institution of Electrical Engineers (British), March 21, 1946.

PASSAGE of current proportional to the fourth or fifth power of the applied voltage by crystalline silicon carbide makes the substance useful for many purposes. Protection of an inductive coil connected to discharge the surge energy when current is switched off is one use, as current decay is more rapid than that through an ohmic resistance. It also is useful to protect a decoupling condenser, limiting voltage rise to a safe value. Another use, when combined with a ceramic binder, is as a heating element; and one of the early uses was as a lightning arrester.

A much wider variety of uses of silicon carbide and other non-ohmic resistors is likely as their properties and possibilities become more widely recognized and the analysis and design of circuits involving them become better understood. It also is possible that as the knowledge of silicon carbide increases, improvements in the material may be made to extend further its scope.

Frequency-Biased Tie-Line Control

From an article by R. Keller in "Brown Boveri Review," July, 1945.

MAINTENANCE of frequency on parallel networks and adjustment of generation in each area so as to maintain predetermined power flow over the tie lines, irrespective of changes in consumer load, are difficult. Automatic devices have been developed to control the adjusting motors of the turbine governors until standard conditions are reestablished. By use of frequency and directional power relays in combination, with contacts in series, the source of load increase can be established and simultaneous and possibly contrary action of several controllers prevented.

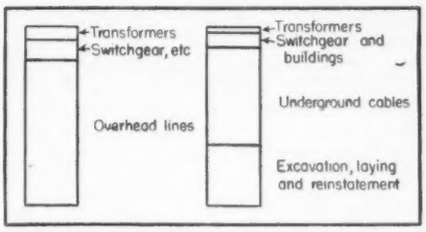
If one network has a drooping frequency-output characteristic and the other a flat frequency-output characteristic, stable parallel operation at constant frequency is possible, the frequency-controlling station normally taking the load variations. A governor radically different from former tie-line controllers has been developed jointly by Brown Boveri and Ateliers des Charmilles, Geneva. In order to insure the desired tie-line flow, it acts directly on the control valve of the servo-piston instead of changing the speed setting of the turbine. The turbine gates of the regulating unit are adjusted primarily according to the load of the network directly connected unless there is a failure of control in one of the other networks, when the tie-line flow is altered to relieve the defaulting station.

Comparative tests with a tie-line controller of more conventional design showed that while both will provide satisfactory operation if bias and regulating speed are properly related, the results on a unit equipped with the new governor are far superior, being comparable with those of elastic converters.

Automatic Voltage Regulation

From an article by E. T. Norris in "The Electrician," London, February 1, 1946.

SPACING of substations and size of cables is determined in England not by load capacity but by allowable voltage drop. The



COMPARISON of capital costs; left, rural overhead lines, right, urban underground cable lines

relative capital cost for distribution systems, as shown in the diagram, is largely for conducting lines, whether overhead or underground. Savings in line cost will greatly exceed expenditures for voltage regulating equipment, comparable with the cost of transformers.

For an extra cost of less than 1 percent of the total supply installation, the capacity of the network can be approximately doubled. There are incidental advantages, such as increase of voltage with load, greater revenue for a given current load, saving in transformers and switchgear, flexibility in system layout, and reduction in no-load losses.

Protective Value Of Lead Coatings

From a paper by A. H. Du Rose before the Electrochemical Society, Birmingham, Ala., April 11–13, 1946.

ELECTROPLATING of lead and lead-tin alloys on steel as a protective coating against the atmosphere and corrosive liquids and fumes has been greatly extended during the past few years. The lead is deposited at room temperatures from a 40-deg. Bé. lead fluoborate solution, containing approximately 218 gm. per liter (29 oz. per gal.) of lead. Addition of a cheap grade of glue increases the throwing and covering power.

Outdoor and salt spray tests lasting more than two years on lead and lead-alloy deposits indicate that the protection is as good as zinc. A copper flash prior to the lead deposit has proved advantageous in some instances, but it seems to be more economical to use a somewhat heavier lead coating. Due to the speed with which lead deposits, less time and cost would be required to deposit 20 to 30 percent more lead than for copper flashing.

Tin content up to 5.5 percent gives a gradual increase in corrosion resistance, but more than this appears to be detrimental. The lead-tin alloy deposits have a better initial appearance and are more uniform in color after outdoor exposure than pure lead.

Adjustable Voltage Drives

From a paper by W. B. Wigton (Cincinnati Planer Co.) at the Westinghouse Machine Tool Forum, Pittsburgh, April 9–10, 1946.

BORING MILLS normally are driven by constant-speed induction motors with gears covering the required range of table speeds. War-time emphasis on production opened the door to the adjustable voltage drive for boring-mill tables. The Ward Leonard principle is used, giving an over-all 20 to 1 speed range without gearing, 3 to 1 by motor field control and the remainder by generator field control. Constant horsepower is available in the 3 to 1 speed range. With one gear change table speeds from 43 rpm. to 2.15 rpm. in the upper speed range and from 10.7 rpm. to 0.5 rpm. in the lower are possible.

Adjustable voltage drive has many advantages over constant-speed drive. Production is high on the list, as the exact speed can be chosen for each job, or even changed progressively as the work goes on. Operator fatigue is lessened, speed changing being handled from a pendant station controlling the field rheostat. Electrical maintenance is easier than mechanical maintenance and can be handled away from the mill.

Adjustable voltage drive costs approximately 2½ times as much as constant-speed squirrel-cage motor drive, or 5 percent of the cost of the boring machine itself; this cost differential will be saved in a relatively short time. It can be predicted that the drive will become increasingly popular for vertical boring mills, and ultimately may be used widely for planers.

Demountable Soundproof Rooms

From an article by W. S. Gorton in "Bell Laboratories Record," New York, April, 1946.

SOUNDPROOF ROOMS at the Murray Hill, N. J., office of the Bell Telephone Laboratories are demountable, being made of panels consisting of two sheets of steel with composition board cemented to their inside surfaces, and separated 3 in. with a rockwool blanket between. These panels are chiefly of one size, 9 ft. 2 in. by 3 ft. 6 in., with filler panels of half this width to close the sides of the room. Floors and ceilings are of four standard sizes, with lengths of 84 in. and 63 in., and widths of 42 in. and 21 in. Thus a variety of room sizes is possible.

Rubber in shear mountings completely supports the rooms, but in all but the smallest rooms it also is placed under the floor beams. Additional insulation is placed under the floor. Doors are of wood, 5 in. thick, with an inner air space.

Noise meter measurements show an attenuation of 43 db. For still more quietness a room of this sort can be inclosed inside another built of similar panels, giving an over-all attenuation of 57 db.

Limitations Of Gas Turbines

From a paper by J. R. Carlson (Westinghouse Electric) before the Midwest Power Conference, Chicago, April 5, 1946.

TWO THINGS have made the gas turbine possible, improvement in compressor and turbine efficiency, and development of high-temperature resistant alloys. Ordinary steels are suitable for temperatures of 825 deg. and carbon-molybdenum steels about 1,000 deg. Steam turbine blades of 13 percent chrome-iron alloy become plastic at 1,350 deg., a temperature considered feasible for gas turbines; obviously such blades are unsuitable. An alloy high in chromium developed by American engineers has exceptional strength at high temperatures. Even with such a material, which costs four to five times as much as the other, it is necessary to reduce the stresses.

The thermal efficiency of a steam plant is 30 to 32 percent (10,000 Btu. per kw.-hr.), and something more than the simple open-cycle gas turbine is needed to match this. By extensively using heat reclaiming apparatus as a regenerator and recooler, the compressor combined with one stage of reheat on the turbine, the cycle will be competitive with steam. Gas turbine parts are large, materials costly and machining difficult, putting the gas turbine at a disadvantage unless the cost can be reduced while maintaining the efficiency.

One way is to operate turbine and compressor at high speed, shrinking dimensions and reducing cost and weight; another is initially pressure-charging a closed system. Instead of compressing air from one atmosphere to ten the system will be charged initially with air at 90 psi. Working with the same pressure ratio, the discharge of the compressor will be 900 psi., reducing the size of rotating parts in the ratio of absolute pressures, or to one-sixth. Numerous advantages ensue, such as always circulating clean air. The externally fired air heater, permitting use of solid fuels, is most important, but the greatest single handicap is the extremely high cost and difficulty of building it. Success of the externally

fired closed cycle system rests wholly on the ability to build an economic air heater.

For standby and peak service the gas turbine appears to have possibilities, as the no-load losses are small, but for continuous duty and long life no great demand is seen for it as compared with steam.

Joints and End Seals For Pressure Cables

From a paper by L. G. Brazier before the Institution of Electrical Engineers (British).

JOINTS in pressure cable used for high-tension lines are the most important accessories because of their relative cost and their inaccessibility after installation. The cable is fully impregnated with a compound, but after installation dry nitrogen gas is forced inside the cable at a pressure of about 200 psi.

Electric stress on the joint ferrule should not exceed about 70 percent of that on the conductor. Liquid insulation of the ferrule, standard practice with solid cables, cannot be used and lapped paper is adopted. The additional wall thickness in the joint varies from about 0.5 in. for a conductor of 0.2-sq. in. area to 0.3 in. for one of 0.7 sq. in.

The paper insulation of the conductor is removed to form a coned end; and after joining the conductors they are served with the paper in the form of tape or in rolls. After wrapping, a lead sheath is placed over each conductor, the three conductors are placed together and a lead sleeve slipped over them, being sealed to the cable by suitable means. Then a copper sleeve of slightly larger diameter is placed over the assembly, being made gas-tight with glands, and a sealing compound (softening point 50 deg. C., penetration 83 at 25 deg.) is run in between the two sleeves. Suitable arrangements are made for maintaining the gas pressure inside the cable and joint. Finally a concrete "coffin" is placed around the entire joint and filled with bituminous compound.

Much the same procedure is used for sealing cable ends. Porcelain insulators have been developed for withstanding gas pressures of 250 psi.

Cable and joints for 132-kv. service have been tested with 700 surges of 640 kv. and 300 surges of between 650 and 730 kv. without damage or defect developing.

Gas control accessories and means of locating leakage of gas with the aid of pressure-operated switches and electrically operated valves installed in the cable joints also are discussed.

High-Voltage Tap Changer

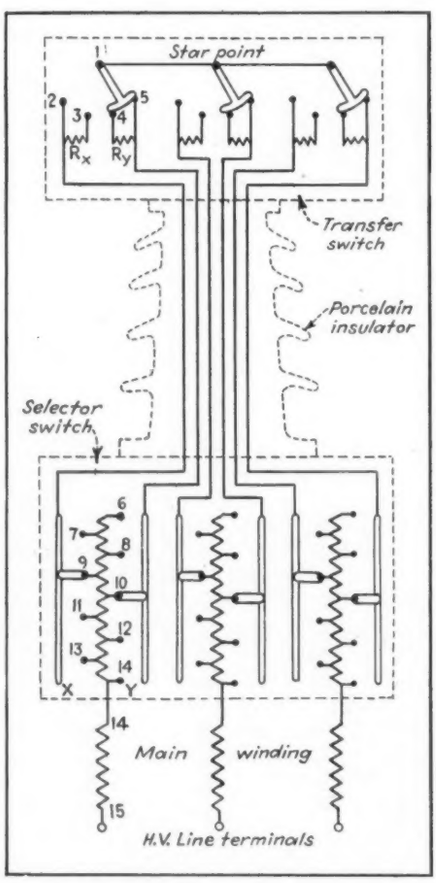
From an article in "Metropolitan-Vickers Gazette," Manchester, England, January, 1946.

SELECTOR SWITCHES made by the Metropolitan-Vickers Electrical Co. for transformer tap changers on insulated-neutral star-connected circuits above 66 kv. depart from the metal-clad construction and are insulated from earth. Two vertical spindle selector switches for each phase are mounted in a tank bolted to the side of the transformer tank or housed in the end of the tank itself. Above the switches is a hollow vertical porcelain insulator through which go the six leads to the transfer switch and the operating shaft. The transfer switch and the spring-driven quick-motion mechanism are immersed in oil in a cylindrical tank bolted to the top flange of the insulator.

Connections are shown in the diagram. Selector switches *X* and *Y* consist of collector rings with contacts around the circle, the moving arm making contacts in turn. The transformer switch above has a single moving contact, *1*, for each phase, and fixed contacts *2*, *3*, *4* and *5*. Resistors R_X and R_Y are connected across pairs of the fixed contacts. The three moving contacts, *1*, are connected to form the star point.

As shown *1* is making contact with *4* and *5*, the latter connected to *Y*, including winding turns between *15* and *10*. To increase turns switch *1* is thrown quickly to connect with *2* and *3*, placing selector switch *X* in circuit. *Y* is then disconnected and may be advanced to *8* ready for a further increase in turns by throwing *1* back to *4* and *5*. Reduction of turns is made by reversing the sequence.

Advantages claimed are that (1) the single porcelain insulator provides the major insulation for the three-phase transformer switch; (2) the same assembly can be used for a considerable range of ratings, and (3) the switch, contacts and mechanism are readily accessible for inspection and renewal.



CONNECTIONS for high-voltage tap changer for transformer

Gophers Eat Cables

From an article by F. B. Livingston in "Bell Laboratories Record," New York, April, 1946.

DESTRUCTION of the lead coverings and insulation of buried coaxial cables by gophers has proved a serious problem in rodent-infested territory in the prairie states. To devise a protective coating a series of tests was made by the Bell Telephone Laboratories, using captive gophers. It was found that a wrapping of steel tape outside the cable sheath was attacked at once. Copper tape was more effective, but 5-mil tape was ruined on the average within three weeks. Tapes of 7 mils and 10 mils were tried, and only one of the gophers was able to damage the 10-mil tape. Accordingly, 10-mil copper tape was considered a reasonable risk and it is being used as a combination gopher and lightning protection on the Dallas-Los Angeles coaxial cable now in production.

Metal Thickness Measured from One Side

From an article in "The Electrician," London, January 18, 1946.

METAL THICKNESS may be measured from one side with a meter designed by Salford Electrical Instruments, Ltd. It employs an oscillating crystal which is held against the surface. At the resonant frequency of the material, the crystal is damped and may be caused to alter the indication of the meter, which is in the crystal oscillator circuit. The instrument is particularly suitable for measuring thickness of cable sheaths, pipe lines,

boiler shells and tanks, or wherever the two opposite surfaces cannot be reached simultaneously.

Efficiency Loss In Power Plants

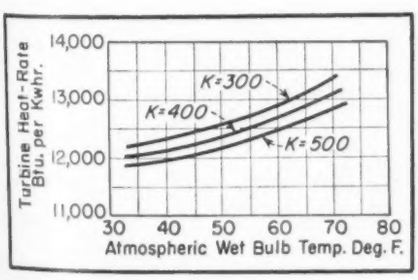
From an article by C. H. Fielding in "Electrical Review," London, March 8, 1946.

VARIOUS FACTORS reduce efficiency of a power station below optimum. Load factor is probably the principal cause of loss. For an annual load factor of 50 percent the correction factor is about 0.89 and for a load factor of 20 percent it is 0.77.

With cooling towers vacuum will be about 28 in. with 30-in. barometer and cooling water intake at 75 deg. F. Variation of this 10 deg. either way from normal will cause a change in vacuum of ½ in. and vary the steam comsumption 2.5 percent.

Observed banking losses for boilers of 100,000-lb. per hr. rating are between 200 and 500 lb. of coal per hour. This wide range shows the need to keep all dampers and valves tight. Soot blowing on a large modern boiler uses about 5 percent of boiler output during the blowing period. Condensed steam is usually passed to the drains from the superheaters while they are being brought up to temperature. In one station the loss amounted to about 2,500 lb. per duty cycle for a 100,000-lb. per hr. boiler.

Blowdown loss depends on the method of feed water treatment. With one method there is continuous extraction of about 2,000 lb. of water per hr. or 0.7 percent of the steam generated. Fouling of air heaters and economizers may increase the exit temperature of the gases by as much as 50 deg. F. with corresponding loss in boiler efficiency.



EFFECT of condenser fouling and wet bulb variation on turbine heat rate

Condenser fouling caused by algae growths may be reduced by chlorine injections. The diagram shows the effect on turbine heat rate of various values of over-all heat transfer coefficient, K, which is in Btu. per sq. ft. per hr. per deg. F.

Space Heating With Heat Pumps

From an article by A. Ostertag in "Escher Wyss News," Zurich, Switzerland.

INITIAL COSTS of heat pumps are so high that, for building heating, auxiliary heat should furnish approximately half the maximum requirement. For the climate of Zurich, with this combination the heat pump can supply more than 95 percent of the annual heat. As the heat pump is most efficient with minimum temperature range of the circulating water, radiation should be designed for the lowest permissible maximum temperature. Central heating systems with temperature range of 90-70 deg. C. may be used where the requirements are sufficiently large, and can furnish all the heat down to an outside temperature of 1 deg. C., but the efficiency is greater with a range of 70-50 deg. C.

Another excellent use of the heat pump is to supply hot water, either alone or in connection with a space heating system. In Lausanne the ice rink furnishes enough hot water for the town, with a saving of 550,000 kw.-hr. for one winter season above separate water heating.

The table indicates what may be expected from typical installations.

Effectiveness of Heating with Heat Pumps

Type of Heating	Hot Water Temp., Deg. C.	Annual Use Factor		Percent Max. Load Carried		Percent Annual Heat Supplied		Price Parity Ratio, 1 kg. Coal to 1 kw.-hr.
		System	Heat Pump	Heat Pump	Auxiliary	Heat Pump	Auxiliary	
Radiation								
Heat pump alone	50	21.7	21.7	100	0	100	0	0.81
With auxiliary	50	21.7	41	50	50	95.3	4.7	0.82
Central plant								
Usual water temperature	90	21.7	33.5	45	100	72	28	0.54
Lowered water temperature	70	21.7	32	67	75	99	1	0.62
Factory								
Air heater for peaks	80	14.5	25	57	43	98.5	1.5	0.55
Hot water supply								
Heat pump alone	50	All year		100	0	100	0	0.74
With auxiliary	80	All year		50	50	50	50	0.74

8 to 1 Speed Range For D.C. Motor

From a paper by R. W. Moore (Westinghouse Electric) at the Westinghouse Machine Tool Forum, Pittsburgh, April 9–10, 1946.

SPEED RANGE of 8 to 1 by field weakening is possible with a d.c. motor having a multipole double-field stator and a two-circuit armature. Such a motor reduces cost of a machine tool, as less gearing is required, practically stepless control of speed provides flexibility, and greater output is assured.

Two ways of building such a motor are possible. The one suggested by Glenn Spohn of General Machinery Corp. embodies two sets of main poles axially mounted in the stator with respect to the armature, whose conductors cut the flux from both sets. The other, proposed by Westinghouse, has the same number of main poles mounted circumferentially in the stator with respect to the armature.

In the Spohn motor one set of poles is maintained at full strength while the others are varied from full strength cumulative through zero to a differential value needed to attain top speed. This motor will have strong fields at all speeds except when the second set is at zero. A similar change in field strength is obtained in the Westinghouse design. By special design of the pole tips satisfactory commutation can be had at eight times base speed. Good regulation is obtained over the speed range.

Electrical Properties of Soil

From a paper by J. S. McPetrie and J. A. Saxton in the "Journal of the Institution of Electrical Engineers," (British), December, 1945.

MODULUS of the reflection of a grass-covered sandy loam site for radiation of 5-m. wavelength, found as the result of a year's measurements, varied between limits of 0.5 and 0.7. This corresponds to a range of values of 5 to 25 for the dielectric constant and of 0.7×10^8 to 4×10^8 e.s.u. for the conductivity. Measurements of the attenuation in soil at wavelengths of 5 m. and 2 m. indicated similar values for the electrical constants.

Measurements were made with a horizontal transmitting aerial 12 m. above the ground and a horizontal tunnel with its top 1.85 m. below the surface, the soil being undisturbed above the excavation. An exactly similar tunnel was dug nearby, with 1.15 m. of undisturbed soil above, to act as a check.

EDITORIALS

S. B. WILLIAMS, *Editor*

Dual Rates for Wholesale Power to Co-ops

RECENTLY REA Administrator Claude R. Wickard, writing in the *REA News*, criticised bitterly the practice of some utilities in giving to co-ops a low wholesale rate for general rural resale service with the reservation that a higher rate will apply for resale to high demand customers.

This the administrator calls a "dual rate" and labels it as an "unfair, discriminatory device to restrain the free flow of energy whenever it is demanded."

Because of the language and argument used it is suspected that the administrator was less concerned with the alleged effects of the so-called "dual" rate than he was with the opportunity again to attack the private utility industry. The circumstances, however, are not quite the same as he would lead his borrowers to believe.

It was admitted by Mr. Wickard that some of those private company wholesale rates are very low, but why doesn't he say that they are extremely low in areas that are largely undeveloped electrically? These low rates are to stimulate rural development. Isn't that what REA was set up for—to bring electricity to farmers who had been denied electric service?

Of course, rural areas will have small plants for processing farm products, and they are just as much a part of the rural economy as the farms. They should get service by all means. Most, if not all, of the wholesale rates accept these loads unless they have a large demand. And when the loads are not acceptable under the restricted schedules it is seldom if ever that the co-ops cannot resell at the standard tariff.

It begins to look suspiciously as though the administrator wants the special low rates either so the co-ops may make more money selling the industrial load or else sell at less than standard rates so as to lure load away from the very companies that are extending the low wholesale rates. Does he want to establish industries in co-op areas that will be competitive with those outside as the result of special privilege intended for the economic benefits of farms?

As a matter of fact, instead of criticising the companies for the so called "dual" rate, REA should appreciate the fact that the companies have met the co-ops more than half way in extending a rate below the standard wholesale rate for resale, a rate that will permit co-ops to develop their areas. These low rates are not profit rates, but are based on increment costs. They do not carry their share of overhead and investment costs.

Some day it might not be a bad plan for the companies to inquire of Mr. Wickard whether he is using these low rates to develop usage by passing on the savings to users.

Power Plant Illumination

LIGHT—good lighting—is essential to proper operation of equipment in power plants. There is not much dissatisfaction with the illumination provided in the "basement" where the pumps and other auxiliaries are located. Supplementary lights are used when maintenance or repairs are undertaken. The principal remaining task is to do a good job of lighting at the instrument boards and control centers. That makes the problem very much the same as what is encountered at the main control and supervisory centers on the turbine and boiler operating floors.

But there seems as yet to be no universally superior way of providing the illumination for these major areas. The reasons are apparently two—one that conditions range from high ceilings in wide rooms to low ceilings in narrow switch galleries, the other that most of the surfaces of eye interest are vertical.

This matter of vertical panels and instrument arrays makes the problem quite different from that of providing good illumination for the horizontal working surfaces most commonly found in industrial plants. Illumination engineers of the power companies have good answers for the requirements of their industrial clients. But reports have it that they lack an equally good answer when they are invited by the power plant designers and operators to suggest a comparable treatment for the areas inside the power plants.

If they really want a tough bone to sharpen their teeth on they could tackle the job of illuminating the instrument dials for glareless and sharp visibility. Here, in particular, a wide variety of solutions has been attempted—even to the point of placing lamps behind translucent dials. Yet few of the installations are as near the ideal as they should be. It is a good field for exercise by the illumination engineer.

A Study of the Backlog Might Be Helpful

IT is nothing now to hear of deliveries quoted as long as next summer and even into 1948, not only on large equipment that normally takes several months to build, but even on some smaller items that take only a short time even on making orders. What kind of a backlog does this reflect?

How much represents inventory buying in anticipation of price advances? Probably not as much as we had after the last war because of escalator contract provisions that

enable the manufacturer to get advances made after date of acceptance.

How much represents pyramiding of orders? Apparently there is more of this than manufacturers had expected. Nearly everyone thinks there is some, but nobody appears to know how much. At the moment, of course, it doesn't make much difference because there isn't enough production to take care of all the firm demand. Since that situation isn't going to last forever there might be some advantage in manufacturers making spot checks of orders in certain lines. If there is any considerable amount of pyramiding it should show up then and manufacturers could act accordingly and not get over-extended themselves.

Finally, how much represents ordering well in advance of requirements to be sure to have the material when needed? It would be surprising indeed if there were not considerable of this kind of buying. Here again a spot check might disclose approximately the extent.

Some manufacturers are beginning to make studies in order to check their future course. If everybody started to make inquiries at the same time, the customers might not like to be bothered, as they would be. Perhaps there is some simple way in which the broader questions can be answered sufficiently to give general guidance.

When Is a Co-op a Utility?

WHEN is an incorporated power system not a public utility? The answer, according to the Arkansas Supreme Court, is when the corporation serves but one customer.

This interesting decision came up in connection with the Ark-La Electric Cooperative, Inc., which the Arkansas Department of Public Utilities had previously held came under its jurisdiction. In vacating this order the court found that Ark-La was under no obligation to furnish electrical energy to anyone other than the Defense Plant Corporation with which it had contracted.

Here is a corporation formed by a number of co-ops and financed by REA to serve a large industrial customer. It is true that the customer was a public body, but there is nothing in the decision to indicate that the ownership status of the customer made any difference. In fact, the same kind of a decision could have been rendered on the legal philosophy advanced had the customer been any private organization.

One interpretation of this decision might be that there is nothing, at least in Arkansas, to prevent a co-op, or group of co-ops, from escaping the regulation of a state commission when serving wholesale loads provided there is a separate incorporation for the supply system for each customer.

Another and more likely interpretation, however, is that the court has served notice that co-ops cannot generally serve customers outside their area without coming under commission jurisdiction regardless of what their charters contain.

The Excitation Gamut

ABOUT everything conceivable has been tried as a reliable source of excitation for alternators. As one operator put it recently, some systems have played all the way up the scale and all the way down again. There have been steam-driven exciters, motor-driven exciters, shaft-driven exciters, more recently a revival of the house-generator (with separate turbine drive) and, newest of all, the electronic exciter. There have been back-up supplies of identical nature in some cases, and, in other cases, a purposeful resort to a different kind of source. In many of the variations the situation as to excitation is complicated by the decision as to auxiliary services.

Whatever the other influencing factors, the dominant objective is reliability of the excitation and auxiliary supply coupled with unimpaired voltage when the system experiences a serious fault. Of course, after this requirement is taken care of there is still the need that the auxiliaries and the excitation can be reestablished if the station goes down and is detached from the system. Generally speaking, the reliability of interconnections—lines and switching centers—has improved to the point where there is justification for basing the choice of auxiliary and excitation service on the assurance such reliability gives. If that is done 100 percent the answer is likely to be as simple as a transformer connected directly to the generator leads along with a sectionalized auxiliary bus.

Nothing is strictly foolproof but at least the simplest hook-up justifiable in the particular circumstances is the one least likely to be subject to human error or equipment frailty. Complication for the sake of insurance can multiply the number of points at which errors can occur or be perpetrated.

Power Transformer Bottleneck

POWER sales engineers are finding themselves in one pretty dilemma. They have plenty of available power and eager customers, but if the load is sizable they cannot make the sale until they first find a power transformer. If the remarks heard recently at the power sales meeting of the Southeastern Electric Exchange are any indication of the situation in the rest of the country, it would not be surprising if upwards of half-a-million kilowatts of new power load was dependent upon securing power transformers. Some of the load involves construction of new factories which may never be built if deliveries are delayed much longer.

Manufacturers are as eager to turn out the transformers as power salesmen are to get them, but they too have their problems. Strikes in their own plants and in the plants of raw materials suppliers have made the problem all the more acute. In fact, if the strikes in the copper industry hadn't cleared up considerably recently, we might have been faced very shortly with next to no power transformer production.

WASHINGTON COMMENT

By R. N. LARKIN Washington Correspondent

Control of Atomic Energy for Power Purposes

THE difficult subject of atom control, both domestic and foreign, has reasserted itself in recent weeks. The Senate has passed the so-called McMahon bill, which it is hoped will afford effective domestic atom control.

Internationally, the United States has offered to the United Nations Atomic Energy Commission a proposal for internationalization of the control of fissionable materials, their ownership, production, development and use.

Shortly after the secret of controlled nuclear fission first burst upon the United States, Congress was presented with the Army's May-Johnson Bill for domestic atom control. The measure was quickly reported to the House. There it was greeted with such outraged protests that it has been stalled for months. Then a special Senate committee undertook a long study of the subject. Finally it reported the McMahon bill, which recently was passed and sent to the House.

Information Needed

The tedious study which the McMahon committee so obviously made of its problem was designed to give Congress all the information it needed to legislate wisely in a totally new field. Traditionally, Congress seeks information from interests which would be affected by proposed legislation.

In this matter, the McMahon committee heard numerous witnesses from numerous fields. Yet it appears that, in a very real sense, much of it has been in vain.

The reason that this seems true is that much of the basic information about controlled nuclear fission is unavailable to those who have the capacity to translate it into possibilities or actualities in specific fields.

Manhattan District physicists can differ, as for months they have, regarding the time which will elapse before nuclear reactors may prove feasible heat sources for electric power production. No power system engineer or manager has been found who could tell the McMahon committee what possibilities controlled nuclear fission holds for the industry because none has had the pertinent data. Yet the McMahon committee must write legislation which will become basic law. Obviously, any legislation so drawn is drawn with incomplete knowledge.

It may be argued that the use of nuclear reactors as heat sources for electric power generation is too far distant to warrant compromising security by making necessary data known. But the legislation which will establish the ground rules for any such use of nuclear fission is not distant. It is being enacted. The federal agency which will extend this legislation by rules, regulations, directions, curtailments and prohibition is in sight. Only one more body need pass the McMahon bill and one man approve it. Then the Atomic Energy Commission will be appointable. That is how far distant the problem really is, regardless of whether nuclear reactors ever are to be used for electric power generation.

Ownership Status

It may be that this policy of secrecy is beyond the control of Congress. Even if true, this does not improve the situation.

As it stands, the McMahon bill prohibits the private ownership, or utilization without federal license, of facilities for producing fissionable materials. This would make it pretty discouraging to any layman who might be interested in seeking out the possibilities of controlled nuclear fission as a heat source for power generation.

But hope is contained in the so-called "Lilienthal report" on international control of atomic energy, basis of our internationalization proposal. The "Lilienthal report" finds it safe and feasible to allow private ownership of nuclear reactors using "denatured" fissionable materials. When so used, without additional uranium or thorium, the report asserts, "they will not produce further fissionable material." This would indicate that private ownership of nuclear reactors should be all right. It appears also to satisfy the main consideration which will have to be satisfied before private ownership is allowed. That would be a guarantee that no one would obtain the material necessary to make an atomic bomb through the ownership and operation of a uranium pile.

Then enter Bernard Baruch, U. S. member of the United Nations atom commission, who asserted, in delivering our proposal, that:

"Denaturing seems to have been over-estimated by the public as a safety measure."

Willing and Waiting

Since safety is the biggest consideration in allowing private atomic-electric development, this statement, from such a source, poses a real question. Can private power expect anything or can't it? So long as the basic data are secret, no competent answer can be given. Yet some manner of law must be drawn. Further, it must be drawn in such time that the nations to whom we propose international policy will not be rendered sceptical by our own inability to decide the less difficult question of national policy.

About all the industry has been able to say thus far is that it is intrigued with the prospects and is anxious to pursue them under all proper safeguards. Yet, unable to be more specific, it must sit idly by and watch the determination of national policy and national law on the matter.

The power business is often confronted in Congress with the assertion that its woes today would be less had it performed more aptly in the past. It is to be hoped that such an assertion will never greet any future protagonists of the industry who may appear before Congress urging amendment of some portion of the McMahon bill.

NEWS OF THE WEEK

Pacific Coast Association Celebrates Silver Anniversary

Attendance at San Francisco Convention Reaches 941—National Figures, Many from Outside Industry, on Program—Topics Include Public Power, Atomic Power, and Public Relations

WITH a registration of 941, 50 percent greater than at any previous meeting, the Pacific Coast Electrical Association, celebrating its 25th anniversary, held the greatest convention in its history at San Francisco, June 12-14. A number of national figures, many from outside the electrical industry, dealt with some of the economic and social problems that confront the nation.

Former Governor of Colorado, Ralph L. Carr, advocated a sound program for the marketing of federal power in which the power would be distributed through existing facilities, private, municipal and state. Such a policy would realize substantial economic benefits by avoidance of duplicating investment in unnecessary facilities.

"With all the new material available to the public, we are not going to do an adequate lighting job in the home unless someone designs and sells it," declared Myrtle Fahsbender, director of residential lighting, Westinghouse Lamp Division, Bloomfield, N. J. Primary interest rests with the utilities, she said.

California farmers are opposed to federal distribution of Central Valley power because every dollar invested in transmission lines increases the cost of irrigation water to the farmer, pointed out J. J. Deuel, California Farm Bureau Federation. From the standpoint of the irrigationist the best deal is for sale of power output at the dams, he said.

Leonard E. Read, Foundation for Economic Education, New York, said that a program of education is the only way to acquaint the public with the fundamental facts of economics to combat the wave of collectivism that is sweeping America.

"We are on the threshold of industrial use of atomic power, but temperature, corrosion and shielding are major obstacles still standing in the way," stated Prof. Luis W. Alvarez, of the University of California Radiation Laboratory, Berkeley. He reiterated that atomic energy would merely supplement fuel and water power and would not materially affect present energy costs.

In the opinion of H. Vernon Scott, Tax Equality Association, Chicago, the greatest threat to private initiative and free enterprise are the tax-exempt cooperatives which today do an annual volume of $12,000,000,000 and will be doing $50,000,000,000 within five years. Tax equality is the only corrective step, and fortunately Congress is becoming concerned and may do something about it.

Ralph J. Cordiner, vice-president and assistant to the president of General Electric Co., in discussing some "Opportunities and Responsibilities" said that existing inequalities of labor and management are a serious barrier to full production economy, without which the nation stagnates. That labor itself will ultimately realize its stake in a producing enterprise economy, is the most hopeful outlook. Cordiner announced that the General Electric Co. will have eleven plants in the West, exclusive of Hanford, that will employ 10,000 workers, in its decentralization plan.

George F. Meredith, American Public Relations Association, New York, speaking on "Getting Along with People," said that things are done by people and that public attitude toward a corporation is determined solely by the people that represent it. People break down into specific groups, and the only way to poll real public attitude is through a survey by an impartial outside disinterested agency. If public relations are bad, stop doing things people don't like, he declared.

One day of parallel sessions of the Business Development, Operating Economics, and Administrative Services Sections gave these groups opportunities to deal with their specific problems.

Milton G. Sanders, vice-president, Central Arizona Light & Power Co., was elected to the presidency of the association to succeed K. M. Ryals, Stone-Ryals Co., San Francisco.

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Davidson Confirmed

C. Girard Davidson has been confirmed as Assistant Secretary of the Interior. Formerly general counsel for the Bonneville Power Administration and attorney for the Office of War Utilities, Davidson is expected to have administrative charge of Interior's far-flung power interests, including those of the Reclama-

THE OLD AND THE NEW—M. G. Sanders, left, vice-president of the Central Arizona Light & Power Co., newly elected president of the Pacific Coast Electrical Association, and his predecessor, K. M. Ryals, Stone-Ryals Co., San Francisco

tion Bureau, the Power Division, Bonneville, and the Southwestern Power Administration.

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TVA Allotment Followed by Advice to Pay Off Debt

The House has passed the Government Corporations Appropriations Bill, including an item of $25,906,000 for the Tennessee Valley Authority.

Only deletion from the TVA item was $9,666,000 which had been sought for resumption of construction on Watauga Dam, which, with South Holston Dam, was stopped early in the war. The committee approved the project but recommended that work be delayed until materials are more widely available.

The committee report noted the first cash payment to the Treasury from TVA earnings, the sum of $12,597,744, which was paid last December.

Thus far, the committee asserted, TVA has cost $677,969,270 in appropriations, $180,000,000 in earnings, of which $100,000 was for new construction, the remainder for operating expenses, and $65,072,500 derived from the sale of bonds.

The committee recommended that the portion of the cost which can be allocated to power should be amortized over a period of not more than 40 years, and suggested that a plan for repayment be submitted with the next annual budget, adding:

"The investment of the United States in these projects is substantial, and now that revenues are substantial, orderly provision should be made for restoring funds advanced by the Treasury, which would leave a large operating facility owned, free of debt, by the people."

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30 Years' Income Adequate for P.U.D. to Pay for Utilities

Revenues of the Portland General Electric Co. and the Mountain States Power Co., now serving the area in the proposed Marion County (Ore.) P.U.D., are more than adequate to retire the investment involved in 30 years, the Oregon Hydro Electric Commission reported recently. The investment of the two utilities in the territory is given as $2,163,947.

The report indicates that present revenues, after paying all operating costs, would retire an investment of $3,159,000 in the 30-year period. It makes no recommendation as to the feasibility or advisability of the proposed P.U.D., which would include all incorporated cities and towns in the county except Salem, the state capital.

TWO PRESIDENTS—W. C. Mullendore, left, president of the Southern California Edison Co., and J. B. Black, president of the Pacific Gas & Electric Co., at the Pacific Coast Electrical Association convention

Reclamation Bureau Lets Line Equipment Contracts

The Reclamation Bureau will build a 62-mile, 115-kv. line from Seminoe Dam to Casper, Wyoming. The line will replace an existing 69-kv. line and will also serve the Kortes Dam, now under construction on the North Platte River.

A contract for $117,366 for more than 1,000,000 lineal feet of stranded conductor and other equipment has been authorized for award to the Aluminum Co. of America.

Reclamation, meanwhile, has authorized two additional contracts for award to Alcoa for conductor to be used on two projects whose status was in dispute in Congress early this week.

One is a $197,267 contract for 2,041,900 lineal feet of conductor for the 115-kv. Phoenix-Tucson Line in Arizona. This line was junked by the House and restored by a Senate Committee in the pending Interior Appropriations Bill.

The other contract authorized for award is a $246,727 contract for 1,135,200 lineal feet of conductor and fittings for the 230-kv., 150,000-kw. Oroville-Sacramento line, part of California's Central Valley project. This line was approved by the House but junked by the Senate Committee in the pending Interior Appropriations Bill.

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Hobson Leaves Arizona

J. R. A. Hobson, Jr., has resigned as director of the Arizona Power Authority to go to Washington "to engage in other engineering work." Kenneth B. Aldrich, Bonneville Power Administration, is temporarily serving as director.

New Central Valley Bill Adds 300,500-Kw. Capacity

Legislation which would vastly expand California's Central Valley Water Control and Use Project has been introduced by Rep. George P. Miller, California Democrat.

The bill would authorize 13 new projects, containing 300,500-kw. additional generating capacity in seven plants. Estimated cost of all projects is $479,700,000, about $95,000,000 more than the estimated total cost of the project already authorized. The additional power capacity which would be authorized under the new bill would bring project capacity to 750,500 kw. Two power projects in the existing program are now being completed. They are Shasta Dam with 375,000 kw. in five units and Keswick Dam, with 75,000 kw. in three units.

The Miller Bill also provides that the Pine Flat Dam on Kings River, at the southern end of the project, would be operated, and its energy marketed, by the Interior Department. The dam was recently ordered built by the Army Engineers after a long struggle between the Army and the Reclamation Bureau over which was to build it.

Proposed power plants in the Miller Bill are:

Folsom Reservoir, American River, 1,000,000 acre-feet, 60,000 kw., estimated cost $77,900,000.

Bidwell Bar Reservoir, Middle Fork, American River, 1,200,000 acre-feet, 104,000 kw., and Elbow Afterbay Plant on the Feather River, 20,000 kw., estimated cost, $115,300,000.

Pine Flat Plant on the Kings River, at Pine Flat Dam, 45,000 kw., estimated cost $9,200,000.

New Melones Reservoir, Stanislaus River, 1,100,000 acre-feet, 48,000 kw., estimated cost $55,900,000.

Tulloch Reservoir, Stanislaus River, 70,000 acre-feet, 20,000 kw., estimated cost $8,000,000.

Hot Springs Plant at Isabella Reservoir, Kern River, 550,000 acre-feet, 3,500 kw., estimated cost $15,900,000.

Also authorized for all power plants are "necessary transmission lines to load centers."

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Power Franchise Voided

To clear the way for city ownership or to permit the granting of a franchise to another company, Summerville, Ga., has declared the franchise granted to the Georgia Power Co. on June 13, 1924, to be null and void. City officials claim that legal requirements were ignored in the granting of the franchise so that their action is in accord with the law.

Job Analysis and Evaluation Studied by Northwest Electric Light Group

Ebasco Expert Reports on Job Study Being Made for Utah Power & Light—Wage Revisions Made by British Columbia Utility after Job Evaluation Gets Workers' Cooperation

JOB ANALYSIS and evaluation was the subject absorbing most of the interest of a conference of the Personnel Section of the Northwest Electric Light & Power Association at Salt Lake City, June 6 to 8.

J. P. Flemming, Ebasco Services, New York, who is experting the job evaluation study for the Utah Power & Light Co., stated that this study is the systematic process of studying all jobs in an organization to determine the value of each job in relation to all other jobs, to eliminate inequities and to establish pay rates so that the wages at each level are correct in relation to wages at all other levels. It also makes certain that company wages meet employment competition by including in the program a survey of wages in the community.

Job factors used in the Utah company were based on education, manual skill, physical ability, mental and visual attention, responsibility, contact with customers and public, and working conditions.

Sell Top Management First

No plan of job evaluation should be undertaken without top management having been sold on its desirability, said O. A. Petersen, British Columbia Electric Railway Co., who has just completed a job study in that company. The work needs direction by an outside expert with a carefully selected job analyst from the company. Then the organization must be sold down the line, and each employee invited to participate in writing the description of his own job. Supervisors are responsible for the final job descriptions agreed upon in their respective departments before the application of factors to arrive at point values. Final evaluations of the better jobs are reviewed by a committee. Once established and agreed upon, the evaluation should not be distorted, said Mr. Petersen; it must be defensible all the way up and down.

Jobs up to $6,000 per year were evaluated in the B. C. company, and those employees found underpaid were raised, while no pay reductions were exacted from those who were overpaid. In the reorganization within departments which followed, many of the originally overpaid employees were advanced to positions commensurate with their salaries.

Dr. A. S. Bennion, speaking at a luncheon meeting on the subject of human relations in industry, challenged the group by outlining the vast scope open to specialists in this field. He pointed to the scientific approach now being applied to personnel problems and made a plea that personnel directors never overlook the spiritual (not religious) needs of the employees. Although the values gained by adequate personnel direction are difficult to measure, they are none the less present and will pay off in the long run, he said.

In the discussion of accident prevention much attention was given to ways of making safety meetings interesting to the men. It was emphasized that foremen or supervisors conducting these meetings should be trained in programming and in the presentation of their programs.

ACTIVE IN NORTHWEST—At the recent meeting of the Personnel Section, Northwest Electric Light & Power Association, prominent participants were, top, T. W. Lowry, Portland General Electric Co.; O. A. Petersen, British Columbia Electric Railway Co.; and L. W. Nims, Utah Power & Light Co., vice-chairman of the section. Bottom, Don Prairie, Northwestern Electric Co.; C. W. Sherman, Puget Sound Power & Light Co.; and J. P. Flemming, Ebasco Services, New York

No serious problems have developed in connection with the rehiring of returning veterans. Most companies are expanding their operations and readily absorbing not only their own returning veterans but also their share of the younger veterans who went direct from school into the armed services. C. W. Sherman, Puget Sound Power & Light Co., told of making a special arrangement with the unions for an intensive training course for linemen which is expected to produce linemen in 13 weeks. This was found necessary because of the shortage of trained linemen in the area and the inability of the union to furnish men on demand. The course is a streamlined one conducted by foremen in a special training ground where lines are built and all kinds of line work are practiced.

Employee welfare programs were reviewed, including education programs, recreation, picnics, athletics, company camps, sick calls, flowers and similar activities, indicating a liberal indulgence by all the companies in these activities. Sick leave, medical aid, physical examinations, insurance and pension and the policies with respect thereto, were likewise examined, indicating a trend toward uniformity in some of these fields of the member companies. The Utah Power & Light Co. has listed on one sheet a summary of employee benefit plans involving benefits under thirteen headings, the average cost to the company of which is $46 per employee per month. This listing was shown to be extremely helpful in bringing before employees the tangible benefits they enjoyed in this company beyond their rate of pay.

A movement to examine the forms used in personnel work was instituted through a committee headed by J. E. Yates, Pacific Power & Light Co. It is to emphasize the use of a minimum number of personnel forms and a comparison of forms used by different companies for similar purposes.

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More Work So Georgia Tech Organizes Institute

Georgia Tech has organized the Georgia Tech Research Institute as successor to the earlier Industrial Development Council because of the increased volume of industrial research and development conducted at the school.

The Institute will implement and coordinate the utilization of Georgia Tech research facilities for industries, associations, government agencies or individuals in search for new or better products, in the development of technical processes, or in the prosecution of fundamental research.

Kentucky Utilities Starts Tyrone Plant Construction

25,000-Kw. Unit Is to Go on Line in 1947—Cost Will Be $2,612,000—Additional Units Will Follow

Kentucky Utilities Co. has started construction on its new $4,336,000 steam-electric generating station located on the Kentucky River at Tyrone. Initial installation will be a 25,000-kw. unit which will be completed early next year.

N. P. Taylor, assistant chief engineer, stated that $2,612,000 has been set aside in the budget this year for work on the new station. The entire cost of the project, he said, is estimated at $4,336,000 including the first generating unit, together with associated substation and 18 miles of double circuit 69-kv., 300 Mcm. copper wood pole transmission line to connect the plant to the company's system.

Anticipating the need for additional capacity at Tyrone, the company will let contracts this year to cover a second 25,000-kw. unit with associated boiler capacity and accessories, together with additional substation capacity and approximately nine miles of double circuit 69-kv. transmission line from Tyrone to the Louisville-Dix Dam transmission line. Work will begin next year on this project.

Boiler and generating capacity, now under construction at Tyrone, will be completed early next year and will supply power to the Central System of the company. The second generating unit with associated boiler capacity will be completed in 1948 for anticipated load increases in the area.

The company's total construction program for this year is $5,664,000, as compared with $2,368,000 spent in 1945.

Other Projects Planned

Other work planned by the company includes:

Construction of 39 miles of 69-kv. line from the company's Park generating station to the Kentucky-Virginia state line to connect with facilities of the Old Dominion Power Co. at their Pocket generating station, to cost $293,000.

Numerous short transmission line extensions and new substations to serve new coal and fluorspar mining operations.

The construction of approximately 400 miles of rural distribution lines.

The construction of eight miles of 33-kv. line with metering equipment to connect the company's system at Morehead with Kentucky & West Virginia Power Co. system at Haldeman.

Scheduled for completion is the 5,000-kva. substation at Calhoun and the eight miles of 33-kv. line to connect the 33-kv. system in western Kentucky coal fields with the 66-kv. Earlington-Owensboro line to augment existing supply and provide a two-way feed to this area. This work was started the latter part of 1945.

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Tampa Gives Pay Increases

Tampa Electric Co. has granted an 8 percent raise to approximately 300 production employees represented by the International Brotherhood of Electrical Workers, A.F.L. The increase was added to wages ranging from 68 cents to $1.52 an hour and was granted to compensate workers for a proposed reduction of working hours from 48 to 44 hours a week.

A $15 a month increase has also been given 120 office employees represented by the Office Employees Union, A.F.L.

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BPA Serving Milton, Ore.

With energization of a new 66-kv. transmission line, Columbia River power is now being served to Milton, Ore., by the Bonneville Power Administration. A residential rate schedule ranging from ¾ cent to 3 cents per kw.-hr. was put into effect.

QUICK RECOVERY—Service was practically normal on the Boston Edison System 48 hours after a severe electrical and wind storm on June 8. Here workmen in Newtonville, Mass., prepare to restore service on a 4,160-volt, three-phase feeder circuit on a joint utility, municipal signal, and telephone pole line

Southern California Power May Supply Nevada's Need

Los Angeles Approves Annual Sale of 200,000,000 Kw.-Hr. and Utility May Provide State With Equal Amount

Long-drawn-out negotiations between the state of Nevada and Southern California power agencies seemed to be nearing an end last week, marking a partial solution of Nevada's mounting power problems.

Governor Vail Pittman, chairman of Nevada's Colorado River Commission, who has been attempting for several months to obtain an added allotment of Boulder dam power, announced last week that the Los Angeles Board of Supervisors had approved sale of 200,000,000 kw.-hr. of electrical energy annually to Nevada at a rate of "slightly over 3 mills per kw-hr." It was believed that this offer would be matched by Southern California Edison Co., which with the Los Angeles Department of Water & Power, control a major portion of Boulder Dam energy.

Nevada Seeking 35,000 Kw.

Nevada at the present is seeking 35,000 kw. Under an existing agreement with Southern California Boulder Dam power users, the state can obtain up to 44,000 kw. without installing an additional generator, if advance notice is given of from six months to three years, depending on the amount of power desired. Preventing an agreement between the two groups on immediate Nevada needs, however, has been a fuel oil price increase that the Nevada group wished to ignore, and that the Californians termed important. The Southern California bloc presumably will allot the 35,000 interim kw. at a 3.25-mill rate that is tied in with fuel oil escalator clauses in the contracts, although Nevada industrialists already are protesting this rate as too high for economical plant operations.

Uppermost on Nevada's mind is the problem of needed electrical power that must be immediately channeled to new industries located at the state's basic magnesium plant. If the interim power negotiations are satisfactorily completed, this energy supply will, Nevada hopes, be assured until generator installations tentatively contemplated by the Bureau of Reclamation can be installed at Boulder Dam. The new Nevada generator would require application to Congress for needed funds that are estimated at between $4,000,000 and $5,000,000, and if approved, the installation would require at least three years to complete.

Earlier, Nevada and California power engineers had drawn up a plan under which Nevada and Los Angeles would both benefit from the projected unit.

1946 'Better Copy Contest' Awards Made by P.U.A.A.

40 First Places and 78 Honorable Mentions Announced at Atlantic City Convention — 945 Entries

Forty national awards and 78 honorable mentions in the 1946 "Better Copy Contest" of the Public Utilities Advertising Association were announced last week at the association's annual convention in Atlantic City.

A total of 945 entries was submitted in the competition which is the country's oldest national advertising contest. In the absence of Ted B. Ferguson, Texas Power & Light Co., contest chairman, the awards were presented by Clara Zillessen, Philadelphia Electric Co.

There were 16 classifications in the contest and in most the competitors were divided into three groups according to the number of customers served. Group A included utilities with less than 100,000 customers; Group C, over 400,000 customers; and Group B, those between 100,000 and 400,000 customers.

Winners by Classifications

National award winners of interest to electric utilities were:

For electric companies, series of five or more newspaper advertisements—Group A, Potomac Edison Co.; B, West Penn Power Co.; C, Commonwealth Edison Co.

For all utility companies, single newspaper advertisement to maintain public approval of utility—A, Worcester County (Mass.) Electric Co.; B, Cincinnati Gas & Electric Co.; C, Consolidated Edison Co.

For electric companies, single newspaper advertisement promoting the use of electric service—A, Hartford Electric Light Co.; B, Kansas City Power & Light Co.; C, Northern States Power Co.

The following classifications were open to all utilities:

Employee publications—A, Mississippi Power & Light Co.

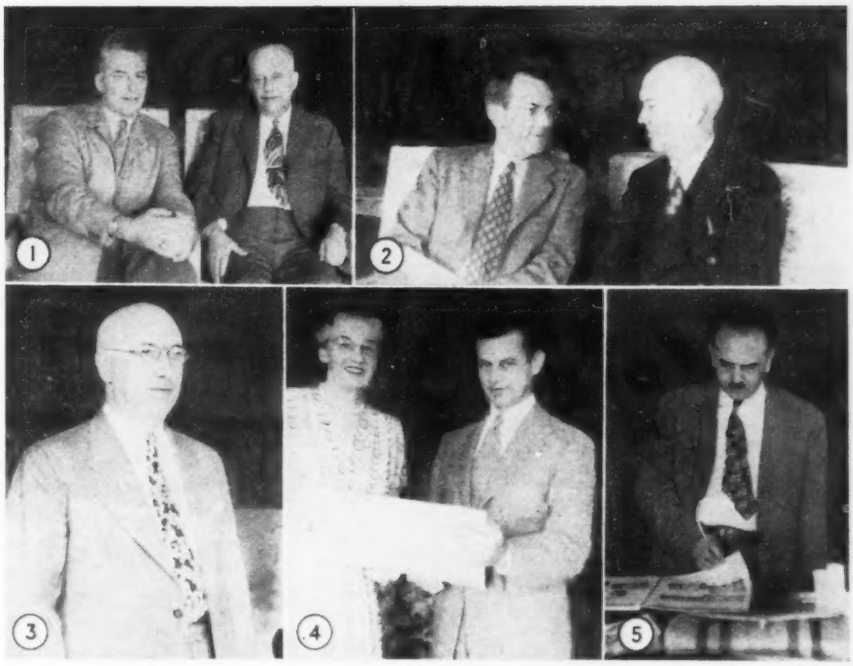
Bill enclosures and other periodicals for residential customers—A, Potomac Edison Co.; B, Public Service Co. of Northern Illinois.

Special booklets, pamphlets, and circulars—A, Colorado Central Power Co.; B, Alabama Power Co.; C, Iowa Utilities Association.

Window display—B, Cincinnati Gas & Electric Co.; C, Consumers Power Co.

Inside display—B, Shawinigan Water & Power Co.; C, Consolidated Edison Co.

Outdoor advertising—A, Montana Power Co.; B, New Orleans Public Service, Inc.



P.U.A.A. CANDIDS—At the annual convention of the Public Utilities Advertising Association, last week, at Atlantic City. 1. Third Vice-President Dale Remington, Wisconsin Public Service Corp., and Robert Plowe, Commonwealth Edison Co. 2. Retiring President E. N. Pope, Carolina Power & Light Co., and his successor, Charles J. Allen, Connecticut Light & Power Co. 3. Second Vice-President Harold S. Metcalfe, West Penn Power Co. 4. Clara H. Zillessen, Philadelphia Electric Co., presents an advertising award to L. Edwin Gill, Jr., New Orleans Public Service, Inc. 5. Walter Heren, Union Electric Co. of Missouri, studies the book of prize-winning utility advertisements

Annual report to stockholders—A, Kansas Gas & Electric Co.; B, Puget Sound Power & Light Co.; C, Philadelphia Electric Co.

Annual report to employees—B, Pennsylvania Electric Co.; C, Consolidated Edison Co.

Radio advertising, no grouping—Union Electric Co. of Missouri.

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Location of Power Plant Doesn't Free It of Taxes

Colfax, La., may levy an occupational license tax upon a power plant (owned by Louisiana Ice & Electric, Inc.) located in Bunkie, some 60 miles away, a ruling by the attorney general's office has stated in an opinion by Francis R. Edwards, special assistant attorney general.

The tax may be levied, the opinion held, upon a firm or corporation engaged in furnishing electric light, heat or power to consumers within the limits of the municipality, even though the electricity so furnished originates in the town of Bunkie, which license shall be based upon the gross annual receipts distributed from the sale of power distributed within your municipality and in accordance with the graduated schedule used for state purposes.

Radiotelephone Service in St. Louis to Begin Soon

Southwestern Bell Telephone Co. has been granted the first license by the Federal Communications Commission to operate radiotelephone service for vehicles. The service will be operated shortly in St. Louis.

Three classes of service will be offered: a general two-way telephone service between any vehicle and any regular telephone or other mobile unit; a two-way dispatch service between a customer's office and his own mobile units only; and a one-way signaling service to mobile units to notify the driver that he should comply with prearranged instructions.

Five receiving (radio) stations will be erected throughout the city. Calls will travel over the regular telephone circuits from the land station to the receiving station and by radio between the receiving station and the vehicle. Charges for a one-minute two-way dispatch call will be as low as 15 cents. The radio equipment on the vehicle can be provided by the owner or by the telephone company. In this case there will a $25 installation charge and a $15 monthly service charge.

Construction of stations has been authorized or is pending in all major cities of the United States.

Copper Outlook Better as Labor Peace Nears

Wire Bar Production Expected to Equal Consumption in July —Government Stockpile Low

The copper outlook brightened considerably this week with indications of an early settlement in the Utah and Arizona copper strikes. It is expected, however, that June and early July will be the most critical periods in copper supplies since consumption has run so far ahead of production and the government stockpile has been depleted to a new low.

Employees of American Smelting & Refining, Phelps Dodge, and Utah Copper are expected to return with an 18½-cent hourly wage boost, plus a 9¼-cent increase retroactive to September 1, 1945. Informants in the mining trade state that refining and casting of wire bars could then begin almost immediately and that 60,000 to 65,000-ton production should be reached by the middle of July.

At present three refineries are operating—American Metal Co. at Carteret, N. J., with an annual capacity of 190,000 short tons, and Anaconda Copper at Great Falls, Mont., with a capacity of 180,000. The International Smelting & Refining plant in Raritan, N. J., with a capacity of 240,000 tons, resumed operations the last week in May. None of the three, however, is operating at full capacity because of the shortage of blister copper.

However, with a return to normalcy in copper mining and refining, an annual capacity of 1,595,000 short tons will be available. The major refineries making this total include A. S. & R., Anaconda, Phelps Dodge, Inspiration Consolidated, and International Smelting & Refining Co.

Unknown Factors Affect Production

Some of the unknown factors which will affect the rate of production increase at the refineries are size of blister copper stockpiles, available supply of labor, and condition of tanks and furnaces. It is known that some furnaces will require major repairs before production can begin.

The government continually has been drawing from the "surplus" stockpile. On May 31, this had reached a new low of 352,818 tons and included 16,652 tons of wire bars and 145,771 tons of ingot bars. The Reconstruction Finance Corporation only recently authorized the reprocessing of a portion of the ingot bars into wire bars.

Electrical manufacturing industry has been consuming copper at the rate of 65,000 tons per month while production of refined copper of all classes from January through May, broken down on a monthly basis, has run 69,008; 49,923; 20,139; 18,989; and 20,551 tons. In normal pre-war periods, approximately 50 percent of copper production was utilized by the electrical industry.

The difference during the present emergency period has been made up from government stocks and the manufacturers using up their normal reserves. Manufacturers stocks are now non-existent and, for the most part, they are operating on a day to day basis.

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Change Made in Directorate

Sam Schweiger, Southwestern Gas & Electric Co., Shreveport, La., has been elected a director of the Public Utilities Advertising Association to fill the unexpired term of Russell I. Seymour, Kansas City Power & Light Co., who has left the utility industry.

MEETINGS

Previously Listed

American Society of Agricultural Engineers—Annual meeting, New Jefferson Hotel, St. Louis, Mo., June 24-26. Raymond Olney, secretary, St. Joseph, Mich.

American Institute of Electrical Engineers—Summer convention, Hotel Statler, Detroit, Mich., June 24-28. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

American Society for Testing Materials — Annual meeting, Buffalo, N. Y., June 24-28. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

Canadian Electrical Association — Annual meeting, Banff Springs Hotel, Banff, Alberta, Canada, June 26-28. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal 1, Que, Canada.

Rocky Mountain Electrical League—Annual convention, Stanley Hotel, Estes Park, Colo., September 5-7. R. B. Hubbard, manager, Gas & Electric Bldg., Denver 2, Colo.

Instrument Society of America — National Instrumentation Conference and Exhibit, Wm. Penn Hotel, Pittsburgh, Pa., September 16-20. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

Illuminating Engineering Society—National convention, Chateau Frontenac, Quebec, September 18-21. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

International Association of Electrical Inspectors—Northwestern Section, Boise Hotel, Boise, Idaho, September 23-25; W. L. Gaffney, secretary, 402 City Hall, Tacoma 2, Wash. Southwestern Section, Hotel Sacramento, Sacramento, Calif., September 30-October 2; H. L. Gerber, secretary, 205 City Hall, San Francisco, Calif. Southern Section, George Vanderbilt Hotel, Asheville, N. C., October 14-16; A. M. Miller, secretary, 910 W. 30th St., Richmond 24, Va. Western Section, Gibson Hotel, Cincinnati, Ohio, October 21-23; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis 9, Ind. Eastern Section, Mark Twain Hotel, Elmira, N. Y., October 28-30; F. N. M. Squires, secretary, 85 John St., New York 7, N. Y.

Municipal Electric Utilities Association of New York State—Annual conference, Mark Twain Hotel, Elmira, N. Y., September 25-27. T. J. McKee, secretary, 200-212 E. Third St., Jamestown, N. Y.

American Society of Mechanical Engineers—Fall meeting, Statler Hotel, Boston, Mass, September 30-October 2. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Tornado Damage Great in Detroit-Canada Area

Major destruction and community-wide power failures resulted from the June 17 tornado which swept through the Detroit-Ontario peninsula area.

The worst concentrated damage was across the western tip of the Ontario peninsula and in Essex County, where Windsor is located. Service into an estimated 50,000 homes in the area was disrupted for periods from a few hours up to two full days.

Two 110-kv. lines of the Ontario Hydro-Electric Power Commission feed into this district from St. Thomas, and both were ripped down. Twelve towers were flattened on the two lines, one an older double circuit and the other a single circuit, and about 2½ miles of lines were torn up. These two circuits were crossed together to restore service into Windsor after nearly a 24-hour blackout.

Close to 200 poles were also blown over by the tornado, and service was not completely restored over these lines until June 19, putting the last of the rural users back on circuit.

Detroit Edison Co., meanwhile, was confronted with the worst trouble it has experienced in the last seven years. After three days of emergency repair work by 800 men, many of them contract crews, damage done was not fully known, although all service had been restored on a temporary basis. Many repair crews worked as much as 30-hour stretches without rest.

Edison's problems began Sunday, June 16, when a storm affected service all through company territory except in the extreme western section and Michigan's thumb area. A total of 168 distributing circuit interruptions was listed by midnight, but nearly all service was restored by the next afternoon.

Two hours later, however, the tornado created three areas of emergency. Its center ripped through River Rouge, tearing down secondary and service lines but not affecting big transmission or distribution lines.

The Mt. Clemens district, where the storm was only slightly less intense, was more seriously affected. Both 24-kv. lines feeding the Harper substation, 15 miles north of Detroit, were torn down, and the distribution circuit and power line from the same substation were wrecked. This caused a 14-hour outage for the water pumping station at Mt. Clemens, and for other facilities at that city.

South of Lapeer, 60 miles north of Detroit, another concentrated blow unrooted a big farm line and disrupted rural service in the vicinity.

Toledo Wants BPA Power Direct, not Through P.U.D.

The Toledo, Ore., Water & Light Commission has asked for a conference with the Bonneville Power Administration for the purpose of mapping out an agreement providing for a city-owned power system. Toledo strongly desires independence of the Central Lincoln County PUD, from which the city now buys its power supply.

This action followed an announcement April 15 by Chesley Brazil, southwestern Bonneville Power Administration manager, that "it would not be feasible for us now to serve the city of Toledo as a separate municipal system.'

Stanley Thompson, chairman of the Toledo commission, said the city is nevertheless going ahead with its plans to operate a city-owned system when Bonneville transmission lines are completed this fall.

Recalling that in November, 1945, he requested Bonneville to supply information looking toward a contract for power to supply the proposed municipal system, he said, "After long silence, we are in possession of conclusive information that some influential Bonneville representatives are determined to compel the city of Toledo to continue its unwilling association with the Central Lincoln County P.U.D. and that it is planned to block our clearly defined right to establish our own publicly owned system and to buy publicly owned Bonneville power."

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Utah Power & Light Rural Project Will Cost $170,000

New transmission lines carrying electricity to rural communities of Box Elder County, Utah, and Oneida County, Idaho, will be completed this fall by Utah Power & Light Co. The $170,000 project, involving construction of 173 miles of line, will reportedly be the longest and most expensive rural extension in the utility's history.

From the Deweyville, Utah, substation, 31 miles of 44-kv. line will run to Blue Creek, Utah, where a 100-kva. substation is to be built. From there voltage will be dropped to 7,200 volts and fed into the remaining 142 miles of distribution line.

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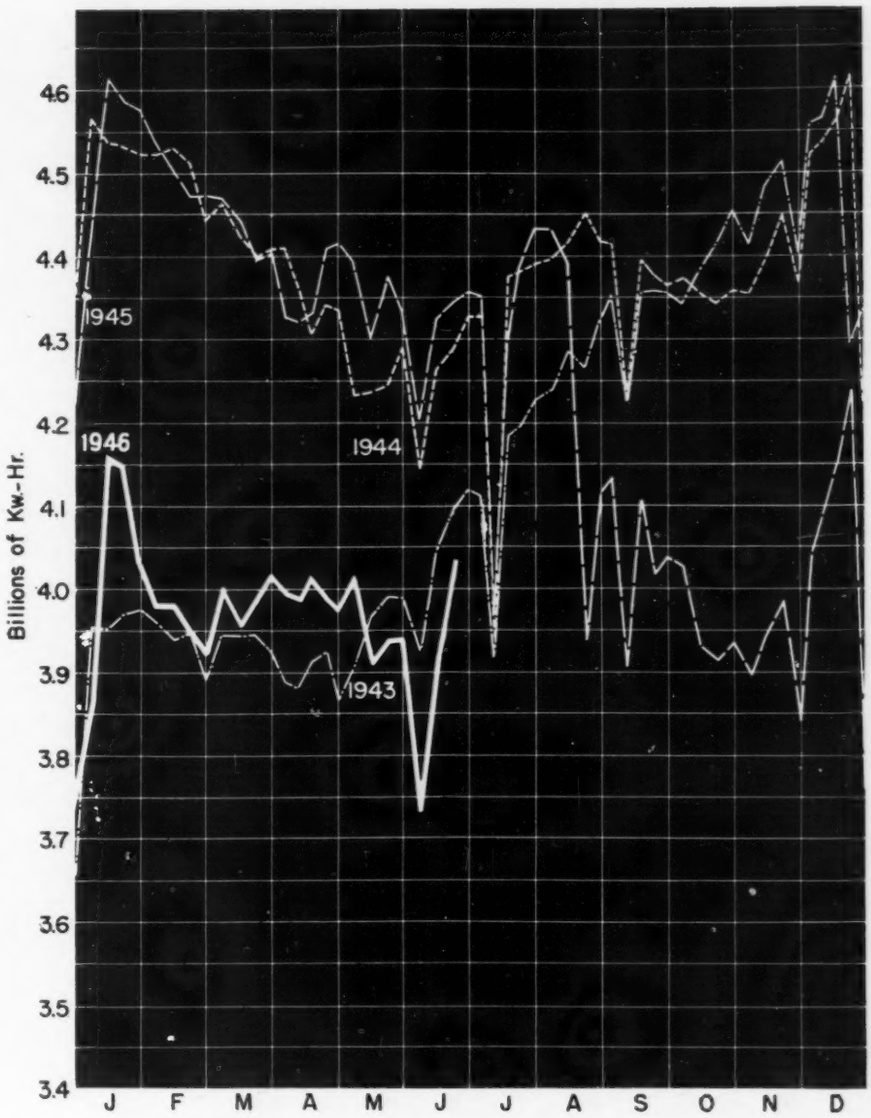
Arkansas Board Backs Co-op

The Arkansas Public Service Commission has refused to allocate territory to the Arkansas-Missouri Power Corp. in the vicinity of Leachville on the ground that the Mississippi County Electric Cooperative is building lines that will provide adequate service.



Electric Output Curve Moves Sharply Upward

The electric output curve swung sharply upward during the week ended June 15, 1946, according to figures released by the Edison Electric Institute, reaching the highest point since the end of January. The amount of electrical energy distributed by the light and power industry totaled 4,030,058,000 kw.-hr. during the week ended June 15, compared with 3,920,444,000 kw.-hr. during the preceding week. During the week ended June 16, 1945, the amount of electrical energy distributed amounted to 4,348,413,000 kw.-hr., this year's figure representing a decrease of 7.3 percent.

Two of the major geographical regions of the country entered the plus column during the week ended June 15, the New England States, which reported a 0.1 percent gain, and the Rocky Mountain States, which showed a 7.2 percent increase. The largest drop was reported by the Southern States—12.1 percent. All sections showed decreased losses as compared with those reported for the week ended June 8.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
June 15	4,030	June 16	4,348	June 17	4,287
June 8	3,920	June 9	4,327	June 10	4,265
June 1	3,741	June 2	4,204	June 3	4,144
May 25	3,942	May 26	4,330	May 27	4,292
May 18	3,939	May 19	4,377	May 20	4,246
May 11	3,911	May 12	4,302	May 13	4,238
May 4	4,012	May 5	4,397	May 6	4,234
Apr. 27	3,977	Apr. 28	4,416	Apr. 29	4,336
Apr. 20	3,987	Apr. 21	4,411	Apr. 22	4,344
Apr. 13	4,015	Apr. 14	4,332	Apr. 15	4,307
Apr. 6	3,988	Apr. 7	4,322	Apr. 8	4,361
Mar. 30	3,992	Mar. 31	4,329	Apr. 1	4,409

Percent Change from Previous Year

	Week Ending		
	June 15	June 8	June 1
New England	+ 0.1	— 0.3	— 3.3
Mid-Atlantic	— 3.7	— 4.4	— 5.0
Central Industrial	— 9.2	—12.5	—15.1
West Central	— 1.0	— 4.0	— 9.4
Southern States	—12.1	—14.1	—15.1
Rocky Mountain	+ 7.2	— 0.5	+12.9
Pacific Coast	— 7.1	— 7.5	—10.4
Total United States	— 7.3	— 9.4	—11.0

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

MISSISSIPPI POWER & LIGHT CO.'s proposal to borrow $3,450,000 on ten serial notes at 2 percent from the Central Hanover Bank & Trust Co. of New York has been approved. The notes will be payable in ten semi-annual installments of $345,000 each, beginning 66 months from their date. Proceeds will be used by Mississippi Power, a subsidiary of the Electric Power & Light Corp., to pay $1,700,000 of 2¼ percent serial notes and to finance construction and improvements. (Release No. 6677).

COMMONWEALTH & SOUTHERN CORP. has been authorized to pay a dividend of $3 a share on its 1,482,000 shares of outstanding preferred stock, the aggregate amount of such payment being $4,446,000. The dividend is payable on the 28th day following commission approval to stockholders of record at the close of business on the 14th day after such approval. (Release No. 6680).

PHILADELPHIA ELECTRIC POWER CO.'s application for authority to refund and refinance its outstanding bonds, demand notes and preferred stock through new bonds, serial notes and additional common stock has been sanctioned. Under the plan the company, a subsidiary of the Philadelphia Electric Co., will sell $30,000,000 of first mortgage bonds at competitive bidding, $12,000,000 of serial notes bearing 1.68 percent interest and maturing semiannually in equal amounts from January 1, 1947, to July 1, 1956, inclusive, and a maximum of 362,000 shares of common stock. The parent company will purchase 120,000 shares of the common stock at its aggregate par value of $3,000,000, and will obtain the remaining 242,000 shares by returning to the subsidiary $6,050,000 of the latter's 6 percent demand notes. With the proceeds Philadelphia Electric Power will redeem $29,731,000 of first mortgage gold bonds, 5½ percent series, due 1972, at 105½ percent, plus accrued interest, and 480,000 shares of 8 percent $25 par value cumulative preferred stock at $28 per share plus accrued dividends. (Release No. 6684).

AMERICAN GAS & ELECTRIC CO.'s proposal to use $22,400,000 of proceeds from the sale of its common stock holdings in Scranton Electric Co. to redeem 204,000 shares of its 4¾ percent cumulative preferred stock at the redemption price of $110 a share, plus dividends, has been approved. The commission also approved another proposal of American to utilize the sum of $3,441,266 from the proceeds of the sale of its Scranton Electric holdings to purchase an additional 200,000 shares of no-par-value common stock of its subsidiary, Ohio Power Co., for an aggregate of $4,000,000. The balance of the purchase price will come from the holding company's treasury. Ohio Power will apply the proceeds from the sale of its common stock, together with treasury cash, to pay outstanding bank loans in the principal amount of $4,750,000. (Release No. 6686).

NORTH AMERICAN CO.'s application for a separate hearing upon and determination of the question whether the properties of Illinois Power Co. integrate with the properties of Union Electric Co. of Missouri under the standards of Section 2 (a) (29) of the Public Utility Holding Company Act, and its request that said integration issue be decided before further proceedings are had with respect to the liquidation of North American Light & Power Co. or the recapitalization of Illinois, were denied. (Release No. 6692).

AMERICAN STATES UTILITIES CORP. and its subsidiaries, Edison Sault Electric Co. and Southern California Water Co., have been granted an extension of time to July 10 to file an appropriate amendment to their Section 11 plan in accordance with an SEC ruling handed down last April. (Release No. 6695).

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Collierville Wants Taxes from Memphis Division

Collierville, Tenn., wants the Memphis Light, Gas & Water Division to pay it the same taxes that the division pays Memphis but so far has been unable to get the division to agree.

Major Thomas H. Allen, of the division, says that Memphis is not paid taxes but is given a payment in lieu of taxes and that under the law such payment can be made only to Memphis. He said that there is nothing to prevent Collierville from installing its own facilities.

When the old Memphis Power & Light Co. operated in Collierville, the city received about $450 annually in taxes. Mayor Charles Dean believes that if the city's tax rate were applied to division gas and electric properties in the city, the payment would be about the same.

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Postpones Delaware Plant

Delaware Power & Light Co. will postpone construction of the new 90,000-kw. power plant it had planned to build in the Cherry Island area on the Delaware River in Wilmington (ELECTRICAL WORLD, March 9, Page 20) because of uncertain conditions, increased costs, and government regulations.

UTILITY REPORTS

	Net Income 1946	1945
*American Gas & Electric and subs	$13,599,217	$10,644,769
*California Electric Power and subs	1,417,996	1,269,060
†Columbus & Southern Ohio Electric	4,316,258	2,864,990
†Duquesne Light	9,466,023	10,085,200
†New York State Electric & Gas	4,894,378	5,799,955
†Northern States Power	7,139,969	6,538,599
†Oklahoma Gas & Electric	2,875,637	2,411,304
*Southwestern Public Service	1,647,429	1,508,168
†Standard Gas & Electric and subs	4,778,417	4,857,158

* Twelve months ended April 30.
† Twelve months ended March 31.

Irrigation Districts Now Using Hetch Hetchy Power

Flow of San Francisco's Hetch Hetchy electricity to the Modesto and Turlock irrigation districts in California began with completion May 13 of the districts' $500,000 substation and construction of 23 miles of tielines to the Hetch Hetchy Moccasin plant. Power generated at the latter will supply the irrigation districts with approximately 10 percent of the total Hetchy output.

Under terms of a nine-year contract signed in July, 1945, dump power of the city thereby will find an outlet, and will facilitate disposal of power under technical compliance with the Raker Act, phases of which stimulated open warfare between city authorities and officials of the Department of Interior last summer (ELECTRICAL WORLD, July 14, 1945, Page 7). The districts will be prohibited from resale of Hetch Hetchy power to Pacific Gas & Electric Co., and from sale of their own power to the utility that might in turn be replaced by Hetch Hetchy electricity.

Other outlets of the city's dump power are Kaiser interests in the Bay area and municipal use. San Francisco was in mid-1945 realizing $2,400,000 annually from sale of its entire Hetch Hetchy output to P. G. & E., a fact government officials considered not in accord with the Raker Act—under which San Francisco built Hetch Hetchy dam on government lands. For that reason the city was restrained last July from further sale of power to P. G. & E., although the utility's transmission lines are leased for delivery of power to San Francisco.

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War Assets Board Offers 117-Mi. Line for Sale

The War Assets Administration has offered for sale about 117 miles of 110-kv. line extending from Walnut Ridge, Ark., to Big Inch pumping stations at Egypt, Ark., and Fagus and Oran, Mo.

The offer is contingent upon agreement by the purchaser to maintain the lines or satisfactory substitutes in condition to supply service to the Big and Little Big Inch petroleum lines should they be restored to service.

Located on separate rights-of-way and possessed of perpetual easements, the lines are of "H"-frame construction and include voltage regulating and service equipment at Walnut Ridge. Also included is a short section of 33-kv. single pole line at Oran.

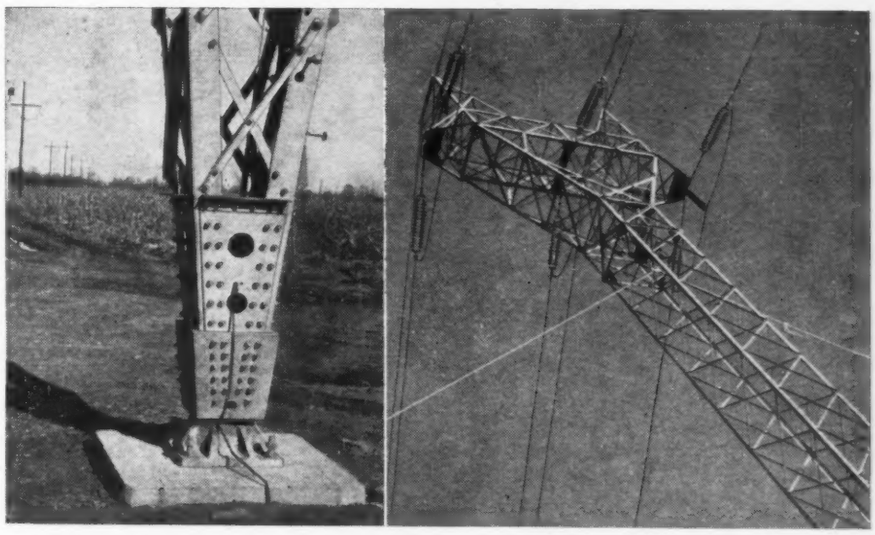
Inquiries should be made to the utilities branch, industrial division, office of real property disposal, War Assets Administration, Washington 25, D. C.

HOW

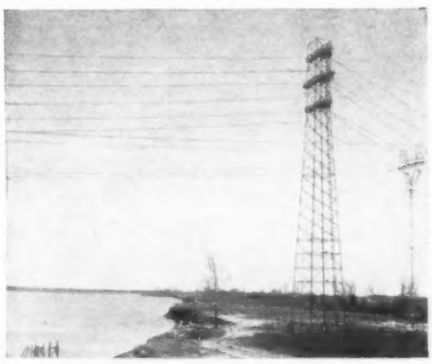
DESIGN • CONSTRUCT • OPERATE • MAINTAIN

River Crossing Tower Stands On One Foot

STEEL DEAD-END transmission towers that support the newer long-span river crossings on the Arkansas Power & Light Co. system are a distinct departure from the familiar four-legged, broad-based, un-guyed structures commonly associated with river crossings. These towers consist of a "point" supported latticework mast of uniform, but relatively small, cross-section topped by a conventional "rams head" to which the long-span conductors and shield wires are dead-ended. Bottom 35 ft. of the mast tapers to a ball resting in socket on a reinforced concrete footing as shown. Two side guys (with turnbuckles) give the structure lateral stability.



POINT SUPPORTED TOWER—Low cost and easy realignment are features of this 195-ft. river crossing structure which literally stands on one foot (left). The latticework mast of uniform section (right) is side-guyed, and topped by "rams head" to which the three 110-kv. special 203,200-cir. mil 15/19 ASCR conductors are dead-ended. Span is 2,480 ft.



TWO TOWER TYPES—Standing in the shadow of a 250-ft. conventional four-footed, double-circuit, 110/66-kv. crossing structure is one of the newer 110-kv., single-circuit river crossing towers of 195-ft. height

Result of this novel arrangement is a structure that is considerably cheaper than the conventional four-footed tower. In most cases the cost of an entire tower of this type is less than the cost of the footings alone for an older type tower. For example, the 110-kv., single-circuit tower illustrated, which is 195 ft. in height and supports a 2,480-ft. span of three special 203,-200-cir. mil. 15/19 ACSR conductors plus two $\frac{3}{8}$-in. E.N.S. shield wires, costs an estimated $50,100. This contrasts with a foundation cost of $100,000 for a 420-ft. conventional four-legged tower that supports a 4,300-ft., 110-kv. crossing at another point on this system. The comparison, while not entirely fair, is indicative of the savings possible.

At the present time there are two river crossings on the APALCO system where towers of this type are in use. Spans of these crossings are 2,480 ft. and 5,040 ft. Tower heights are 195 and 405 ft. respectively.

• • •

Dielectric Heating Used To Cure and Dry Rubber

A MEANS has been provided for creating heat instantaneously at the center of poor heat conducting materials like natural and synthetic rubber. Dielectric heating, as it is known, is the creation of molecular friction uniformly throughout the rubber by the application of high-frequency power. Such power is supplied by electronic generators operating at frequencies of 6 to 30 million cycles per second. A recent installation included a Westinghouse 125-kw., 13.6-Mc. oscillator and control units for either automatic or manual operation.

High-frequency action is said to bond the sulphur and rubber molecules more completely, giving a better cure or vulcanization. In one plant the h-f application to foamed rubber provides a method that is stated to be six times as fast as steam curing and all-oven drying. The precise control of temperature and the uniform distribution of heat combine to give an improved product. Solid rubber products

are uniformly hard throughout, blow holes are eliminated, and under and over cure sections are no longer a problem.

The dielectric heating method has reduced the time for processing operations of preheating, curing and drying. Some itemized savings follow:

Uncured material—preheating prior to molding has cut the molding cycle in half.

Elastic thread—curing time reduced from 15 min. to 1.5 min.

Full size foam mattress—curing time cut from 30 min. to 6 min.; drying time, from 16-18 hr. to 1 hr.

Seat cushions—drying time 1 hr. against 12 hr. by steam oven.

Large hard rubber wheels—cured in 18 min. but in 5 hr. with steam.

Brake blocks—cured in 48 min. and in 7 hr. by steam.

Army tank tracks—after 2 min. of electronic preheating, tracks can be vulcanized by applying steam for only 28 min. but 60 min. are required to cure by steam.

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Control Records Guide Apparatus Maintenance

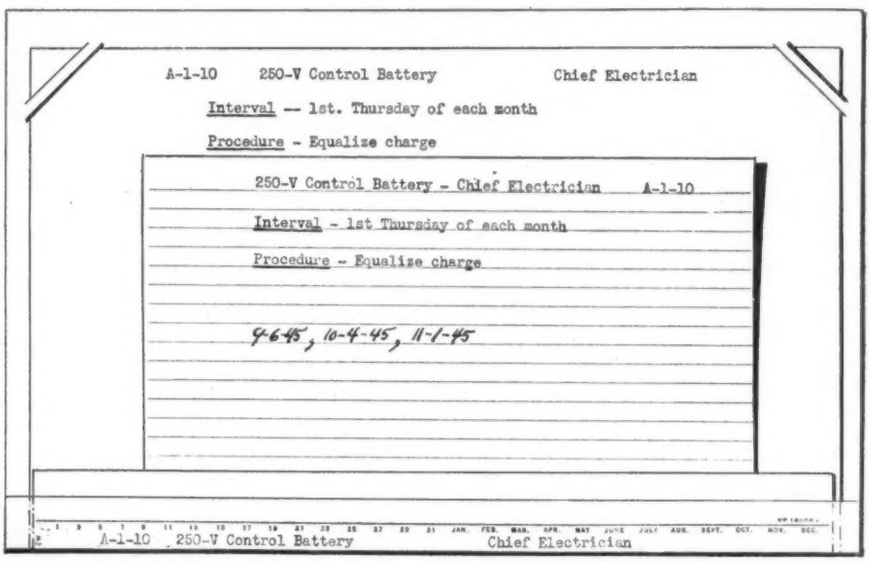
W. L. WILKINSON
East Peoria Station, Central Illinois Light Co., Peoria, Ill.

STATION EQUIPMENT that is not under constant supervision at the East Peoria generating station of Central Illinois Light Co. is called up automatically for a periodic check by a visual type of inspection and maintenance control system that has completely eliminated the element of chance from the scheduling of maintenance of secondary plant apparatus.

The control system performs the following functions: (1) automatically calls up equipment requiring overhaul at different calendar intervals; (2) identifies foreman to whom work should be assigned; (3) describes maintenance procedure and designates date when last performed; (4) visually identifies the maintenance work in progress; (5) provides maintenance supervisor with an instruction card which functions as "work assignment" for the foreman responsible for doing the work.

A visual "flip-over" pocket-type record file is used for this control. Each piece of apparatus has its individual pocket, exposed index of which carries a maintenance code number, equipment designation and name of the responsible maintenance foreman, as well as colored targets on a calendar scale to identify scheduled maintenance dates.

Maintenance code number for each piece of apparatus is in three parts, a letter and two numbers. The letter designates the frequency of inspection and maintenance, the first number is the day of the month on which work is to be done and the second number identifies the equipment as one of a series of jobs to be in progress at that date. This last number also serves to guide the return of record cards to the proper pocket if removed.


A-1-10 250-V Control Battery Chief Electrician
Interval — 1st. Thursday of each month
Procedure - Equalize charge
250-V Control Battery - Chief Electrician A-1-10
Interval - 1st Thursday of each month
Procedure - Equalize charge
9-6-45, 10-4-45, 11-1-45
A-1-10 250-V Control Battery Chief Electrician

SAMPLE RECORD reveals that chief electrician is expected to equalize charge on 250-v. control battery on the first Thursday of every month. Smaller of two cards in this pocket serves as work assignment and instructions to electrician. Dates show when work was done in past

Letter designation in the code number corresponds to the following maintenance intervals: "A"—monthly; "B"—quarterly beginning in March; "C"—quarterly beginning in February; "D"—quarterly beginning in January; "H"—every 60 days starting January; "S"—semi-annually; "Y"—yearly and "T"—three times yearly. Where work is done at intervals more than a month apart, red targets mark the intervals.

Each file pocket contains two cards: a large 5 x 8-in. permanent card and a smaller removable 4 x 6-in. card, both of which carry identical information, as shown in the accompanying illustration. When a job "comes up," the small card is removed and turned over to maintenance foreman who will do the work. It functions as a "work assignment." On the card is the code number, equipment designation, maintenance interval and work procedure. As soon as this assignment card is removed from the pocket, a black dot is uncovered on the pocket index strip showing that work has been assigned

MAINTENANCE RECORDS give quick visual picture of maintenance work in progress and due. Control system functions automatically to call attention to apparatus which needs attention

on that apparatus. Return of the card when work is completed re-covers the dot, showing that work is finished. Thus a glance over the index tabs reveals at once what work is in progress and which jobs have not been finished according to the designated schedule.

Once set up, this control system requires very little clerical work to maintain. Removal and distribution of the assignment of work cards for an entire week can usually be done on the first day of each week since the cards themselves designate the day of the week on which the work should be done. Cards are returned to the file as work is finished and a note entered showing the date of completion.

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Modern and Old Batteries Compared by Test

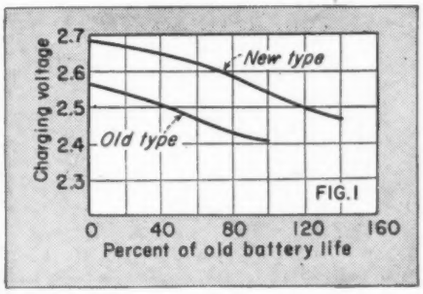

FIG. 1.—Results of tests with old and new type batteries in series

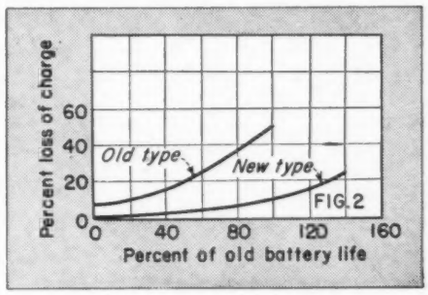

FIG. 2.—Variation of float current necessary to maintain full charge

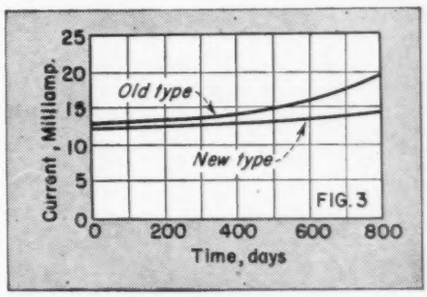

FIG. 3.—Curves resulting from float test, at constant voltage

H. D. STANLEY
Engineer, Philco Corp., Trenton, N. J.

One of the important changes in control batteries since the advent of float operation has come about through the use of a special negative oxide. This type of oxide, originally developed to improve cold weather performance, has been found to have properties peculiarly adapted to use in control work. Negative plates of this oxide, when combined with suitable positive plates, result in a battery with more uniform characteristics throughout life. Sufficient time has now elapsed to prove by laboratory and field tests that the present day battery—

1. Has a consistently higher charge voltage.
2. Requires less current to maintain it on float.
3. Shows a much lower loss-of-charge on stand.
4. Shows less positive grid disintegration.
5. Maintains its capacity for a longer time.
6. Reacts more rapidly to changes in current.

These characteristics can easily be translated into longer life and more efficient operation. Thus, because of higher charge voltage, there is much less danger of damage due to overcharging. As a consequence of the decreased float current there is less grid disintegration and less antimony migration from positive grids to negative active material. Obviously, this means lower loss of charge and longer life. Better capacity performance is obtained as a matter of course under these circumstances. The rapid response of this type of cell to changes in current tends to flatten out the performance curve, eliminating large swings in voltage.

In order to demonstrate the superiority of present day design a series of tests was run in which cells of the old and new design were connected in series. The first of these tests was a constant current float test interrupted weekly for a high rate discharge test followed by a recharge, and semi-annually for capacity at the 8-hr. rate together with a 28-day stand test. Figs. 1 and 2, showing these results, clearly indicate the differences between the two types.

The present day battery shows consistently higher charge voltage throughout life with less change from beginning to end of the test than does the older type. In addition, the loss of charge is considerably lower for the new construction. Upon examination of the cells at end of life for the older type grid, corrosion was greatly lessened in the new type as might be expected because of its improved efficiency. As to capacity, the newer cells were still delivering over 100 percent of rated capacity at 110 percent of life for the older cells. However, the latter group of cells had dropped to 80 percent of capacity at 100 percent life.

A similar group of cells was tested at constant voltage float, 2.15 volts per cell. A flash at the one-minute rate was interjected annually. The curves of float current variation with time are shown in Fig. 3.

Since the float current required to maintain the cells in a fully charged condition is directly related to loss of charge and life it is clear that the new type cell will easily out-perform the old type.

Recently some very interesting results were obtained from tests of the new battery based on known requirements for a certain control installation. The test schedule called for a discharge at a high rate immediately following a partial discharge at the 12-hr. rate. Both undeveloped cells having 85 percent of rated capacity and cells which had been cycled sufficiently to give rated capacity were studied. It was found that the present day battery showed little difference in high rate performance whether developed or not. Furthermore it was found to be possible to discharge either type for approximately nine hours at the 12-hr. rate and still obtain at least one minute at the high rate before cell voltage fell to 1.75 volts.

The present day control battery continually demonstrates its ability, in these and many other ways, to do an outstanding job. Capacity and life have been increased while at the same time maintenance has been simplified and weight and bulk reduced.

Supersonic Beam Detects Flaws in Metals and Plastics

FLAWS as small as one-thousandth inch in a wide range of metals and plastics can be detected by a new Hypersonic Analyzer without injury to the specimen. Its development sprang from the war-time need to discover flaws in rocket powder sticks since any discontinuity in the sticks would result in premature explosion of the rocket rather than the desired uniform propulsive effort.

Briefly, an electronic sound-generator projects a sound beam into and through the specimen under test. Any modification of the beam that results from lack of homogeneity of the material is disclosed as a microphone explores the emerging sound pattern. It is possible to select a critical combination of radiation frequencies and electro-acoustic designs that will accentuate the consequences of any given type of flaw in any given material. Both the transmitter and the receiver are piezoelectric crystals and each functions as a transducer.

The method developed is particularly applicable to materials having a constant cross-section such as those obtained by means of rolling and extruding. The material can be examined continuously as it traverses between a pair of transducers. Changes from its normal homogeneous condition, or flaws, will change the energy level in the microphone. This in turn operates a relay which either marks or rejects the flaw or section of material. Since the frequency of operation normally lies in the region between 50 kilocycles and 1,000 kilocycles per second, the relay action is very fast and the material can flow through at high speed.

Flaws are detected by the Hypersonic method through response to two physical properties of the material; an apparent change in density and/or an apparent change in the modulus of elasticity. Since a single reading or relay operation is obtained, the method does not distinguish as to which property is changed but indicates that either one or both have changed. For example, X-ray essentially inspects for the changes in density or total mass in the field of the beam. The fact that the "Hypersonic" method is sensitive to the changes in modulus of elasticity also gives a distinct advantage over X-ray when it is necessary to examine flaws which are thin slits or cracks in the material.

Quantitatively, when a beam of sound energy is directed through a sheet of steel immersed in water, the ratio of energy in the water on the microphone side of the beam to the energy on the generator side of the beam is:

$$\frac{W_m}{W_g} = \frac{4\,R_1R_2}{4\,R_1R_2 + (R_1 - R_2)^2 \sin^2 Kl}$$

where

W_m = Energy on the microphone side
W_g = Energy on the generator side
R_1 = $\sqrt{E_1 r_1}$ where E_1 is the modulus of the water and r_1 is the density of water
R_2 = $\sqrt{E_2 r_2}$ where E_2 is the modulus of the steel (omitting sheer modes) and r_2 the density of steel
K = $\frac{2\pi}{\lambda}$ where λ is the wavelength of the sound in the steel
l = the thickness of the steel sheet

Actual detection and identification of the flaw or defect may be indicated on a meter, by signal, or, through a relay, may spray paint on the defective spot, apply a rejection stamp, record on a graphic chart or cull the defective portion and eject it. Fluids (oil or water) give better coupling between the transducers and the material than air does, although air or inert gases are often satisfactory media.

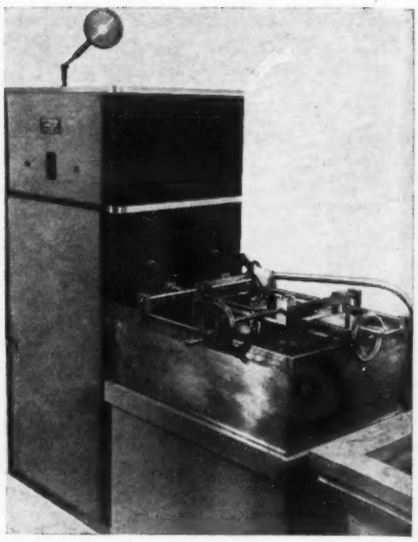

FIG. 1—The Brush Development Co. hypersonic analyzer. Traverse of the transducers (above and below the sample) across the sample effectuated by the handwheels

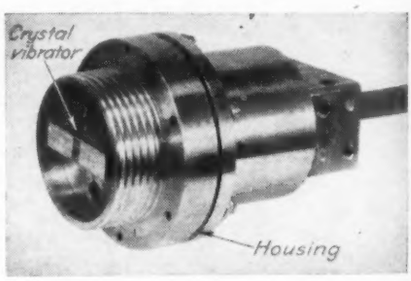

FIG. 2—Piezoelectric crystals constitute the heart of both the transmitter and receiver of 50-1,000 kc. sound-vibration beams. Shown here with cover and band removed

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Distribution Staff Duties Summarized*

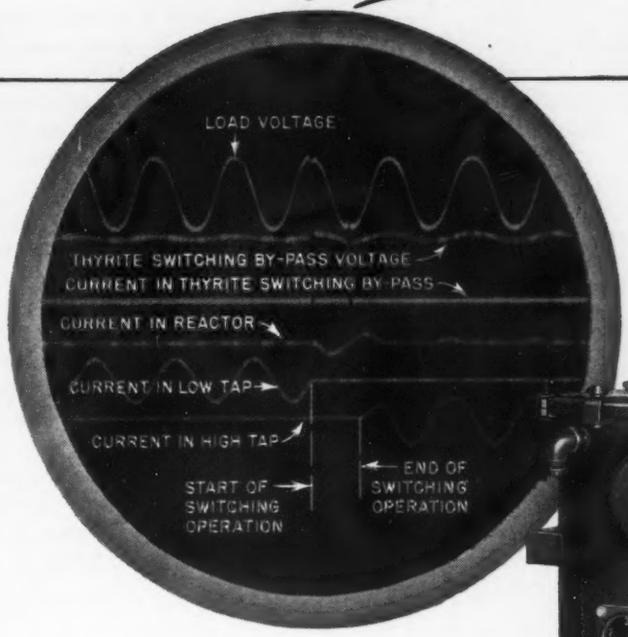
Engineering Draftsman

A PORTION of the company's engineering work in the distribution department, such as mechanical and civil engineering and drafting, is placed upon the shoulders of an employee with the local title of "Draftsman and Engineer." It should be said here that this utility is affiliated with a centrally operated group of companies in which a substantial amount of engineering planning, layout work, etc., is cared for by the group management organization. The work handled by the enginering draftsman of the distribution department of the particular utility considered is of special interest on account of its scope and responsibility for covering many items which are important in the successful operation of the subsidiary.

This engineering draftsman is responsible for the material and equipment contained in the drafting room, including all surveying and drafting instruments, and for the records and

* One of a series of presentations covering the essential duties of officials of a public utility distribution department serving between 50,000 and 75,000 meters. First installment in ELECTRICAL WORLD, October 13, 1945, page 106.

FOLLOW THE *Green Lines* FOR CLEAR-CUT PROOF



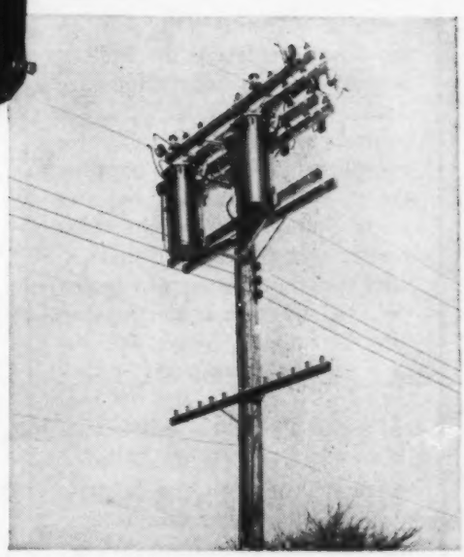
of G-E step voltage regulator's wear-reducing quick-break switching action

Type ML-4 step voltage regulator for single-phase, 60 cycle, 2400, 4800, and 6900-volt circuits.

G-E Type ML-4 step voltage regulators have low initial cost *plus* tested-in-service features that cut maintenance to the bone. They make it possible to extend good, dependable voltage regulation to feeders, which, from the standpoint of service and economy, do not justify the use of the more expensive type of induction regulator.

They are easy and inexpensive to install, because they are small and light in weight. They easily meet the wide range of voltage conditions usually found on branch and rural circuits. They are designed and built with cost saving features that not only safeguard the regulator from electrical failure, but give full protection against mechanical wear as well.

Your General Electric application engineer will gladly tell you of specific circumstances in which Type ML-4 regulators have been used by various companies to avoid the cost of feeder capacity increases, or reduce the cost of line extensions—*in addition to bettering service to customers.* Write for Bulletin GEA-2038D to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Typical crossarm installation of two 12-kva, 4800-volt Type ML-4 step voltage regulators.

GENERAL ELECTRIC

404-45-5400

reports made and kept there. These include records of poles and lines, manholes, transformers, cables, granted locations, reports to municipal, state and Federal authorities. Comprehensive instructions have been issued by the department for keeping such records, including one used in assembling data for the annual return to the regulatory commission in the state. These all guide and direct the engineering draftsman's work. He is made responsible for thorough inspection during construction of work done by a private contractor who may have been hired to install ducts, manholes, pipe or parked cable for the company; and for strict adherence to all company specifications and construction standards in force. It is his duty to see that all measurements and details necessary for records and billing are properly made and recorded during construction, and that proper materials are used. He is required to maintain a set of manhole and duct record drawings.

The engineering draftsman is responsible for all photographic negatives, supplies and equipment which are the company's property.

Upon request he is charged with the duty of providing proper plans in accordance with detailed specifications, as set forth in the company's instructions for preparing plans to accompany a work order. Under him come the carpenter and paint shop, the operation and condition of these places, as set forth in painting instructions for poles, fixtures, ironwork and woodwork. It is his duty to decide upon, oversee and promptly execute minor repairs needed at the divisional headquarters building with suitable help which he obtains. Another important duty is the dispatching and assignment on every working day of all unassigned automobiles used by the department. As far as possible this is arranged before 5 p.m. for the following working day. Regular assignments of cars to particular persons are not disturbed except in case of need. The superintendent of distribution has final jurisdiction over car allocations.

This employee is responsible for maintaining a set of graphic records for the use of the superintendent of distribution, and is required promptly to report to the latter any abnormal condition thus indicated. He is also in charge of the company's monthly car record and similar automobile records. He has stated duties in connection with the keeping of street light and traffic light records, and in relation to the inspection for quality of all pipe bends and fiber conduit for sale. He inspects all property except substation apparatus at the departmental office building and principal in-town substation quarterly before the first Wednesday of January, April, etc., annually.

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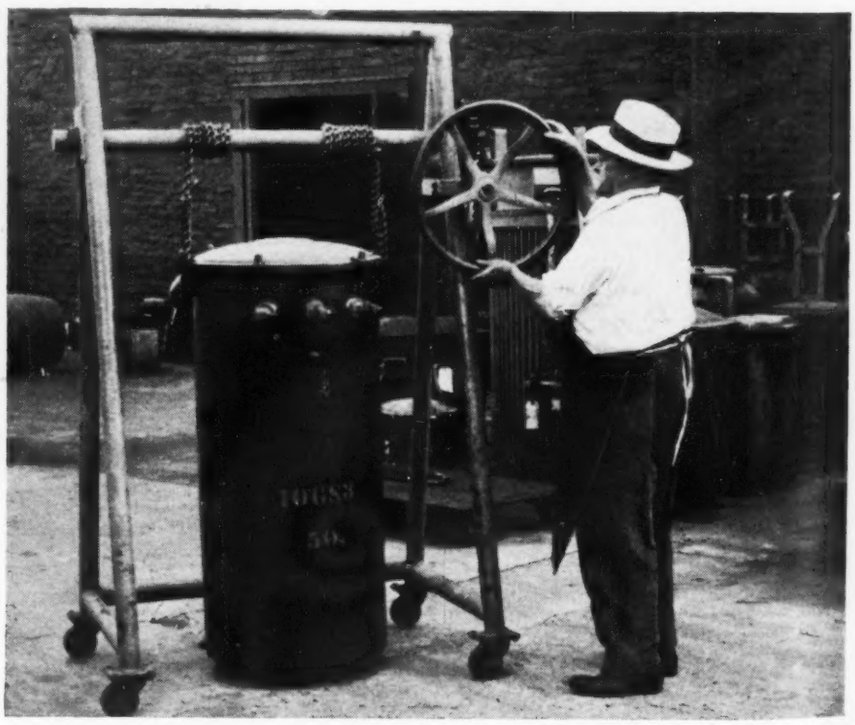
Vibrators Free Coal

G. P. WOMBLE
General Manager, Rocky Mount (N.C.) Public Utilities

WHEN SLACK COAL gets wet it tends to stick and becomes hard to move. We have used Syntron vibrators not only on the hopper entering the boilers, but also on the larry (Standard Scale Supervisory Co.). The controls for the hopper vibrator are placed on the wall opposite the stoker; the vibrator requires up to 8 amp. at 220 volts. Experience has indicated that 15 seconds is long enough to loosen the coal when it is not moving into the hopper; longer application seems to compact it rather than free it. When the wet coal is moving the vibrator is left on continuously.

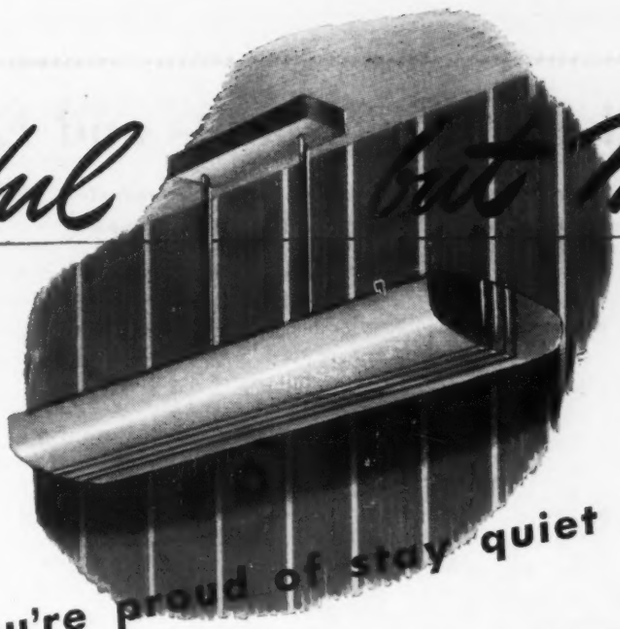
The vibrator on the larry is placed on the under side because the coal brought in from the skip hoist to the bunker also tended to stick when wet.

One Man Handles 75-Kva. Transformer



TRANSFORMER HOIST, built at Lafayette division, Public Service Co. of Indiana, Inc., makes it possible for one man to lift a 75-kva. unit with ease. Formerly two men were needed to lift even the smallest transformer onto a dolly. With the new hoist, transformers unloaded outside the transformer repair shop in Lafayette can be hoisted and trundled inside for repair. Later the reconditioned unit can be moved outside again for storage with the same mobile hoist. The hoist was designed and built by the company's servicemen mainly from scrap parts. Frame members were joined together by welding

Beautiful but Mum!



The fixtures you're proud of stay quiet when they're built with G-E BALLASTS

Your newest fixtures are something to be proud of. Their smooth-flowing lines will please any customer's eye. But can you be sure that annoying ballast hum won't assault his ear?

G-E ballasts are designed to solve this problem by keeping fluorescent fixture noise at practically inaudible levels. They will give years of the quiet service that is so important for concentration during working hours, for peace of mind in leisure moments, and for the customer satisfaction that means increased sales.

QUIETNESS IS BUILT-IN

G-E ballasts are quiet because the quality of the materials and workmanship that go into their manufacture is *controlled* every step of the way. Coils are machine wound for exact dimensions and sealed against vibration with a special clamping and compounding to assure long life and a uniform degree of quiet operation in every G-E ballast you buy.

Cores are of low-loss steel, precisely stamped and stacked. Case and frame are designed to help you wire and mount quickly and easily. Every detail of construction is planned to help give better performance. It is these plus values of G-E ballasts that make them so popular with fixture manufacturers.

For more complete information get in touch with your nearest G-E office, or write to us direct. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

General Electric ballasts help keep fixture users satisfied...they mean *Added Profits for You!*

1. Low noise level—for satisfied users
2. Long life—for low replacement cost
3. Characteristics matched with lamp —for rated lamp life and light output

BALLASTS • LAMPS • STARTERS
LAMPHOLDERS • CABLE
For DEPENDABILITY in fluorescent lighting

GENERAL ELECTRIC

408-41-5205

How to Mark Network Vaults and Equipment

Instructions and illustrations are presented as a guide; an adaptation from a handbook of standards of an eastern electric utility company

ALL NETWORK vaults and all network transformers and protectors shall be designated as described in these instructions. As far as possible the stencilling shall be done before the apparatus is placed in service. Dimensions as shown must be strictly adhered to.

Vaults

Network vaults will be numbered consecutively according to the date of installation. This number shall be displayed on the outside of the entrance door in building vaults and in a conspicuous place on the wall of each compartment in a manhole type vault. In building vaults only, a standard warning sign designed for the system shall be placed below the vault number.

The method of display shall be as shown in Fig. 1. The words "Network Vault" shall be in 1-in. letters and the vault number in 2½-in. letters. A white background with black letters and a ¼-in. black outline shall be used. In building vaults, the warning sign shall be placed so that its bottom edge is 4 ft. from the floor and the white background sign shall be separated from it by 1 in. vertical distance. In manhole type vaults the bottom of the background shall be 4½ ft. from the floor if local conditions permit.

In building vaults having individual transformer compartments, the doors to such compartments shall be marked with the number of the cable to which the primary of the transformers is connected. This number shall be displayed on the outside of the door in the manner shown in Fig. 2. The word "Cable" shall be in 1½-in. letters and the cable number in 2½-in. letters. A white background with black letters shall be used, the white background to be outlined with a ¼-in. black line. A standard warning sign shall be fastened to the door so that its bottom edge is 4 ft. from the floor and the white background sign shall be separated from it by 1 in. vertical distance.

Transformers

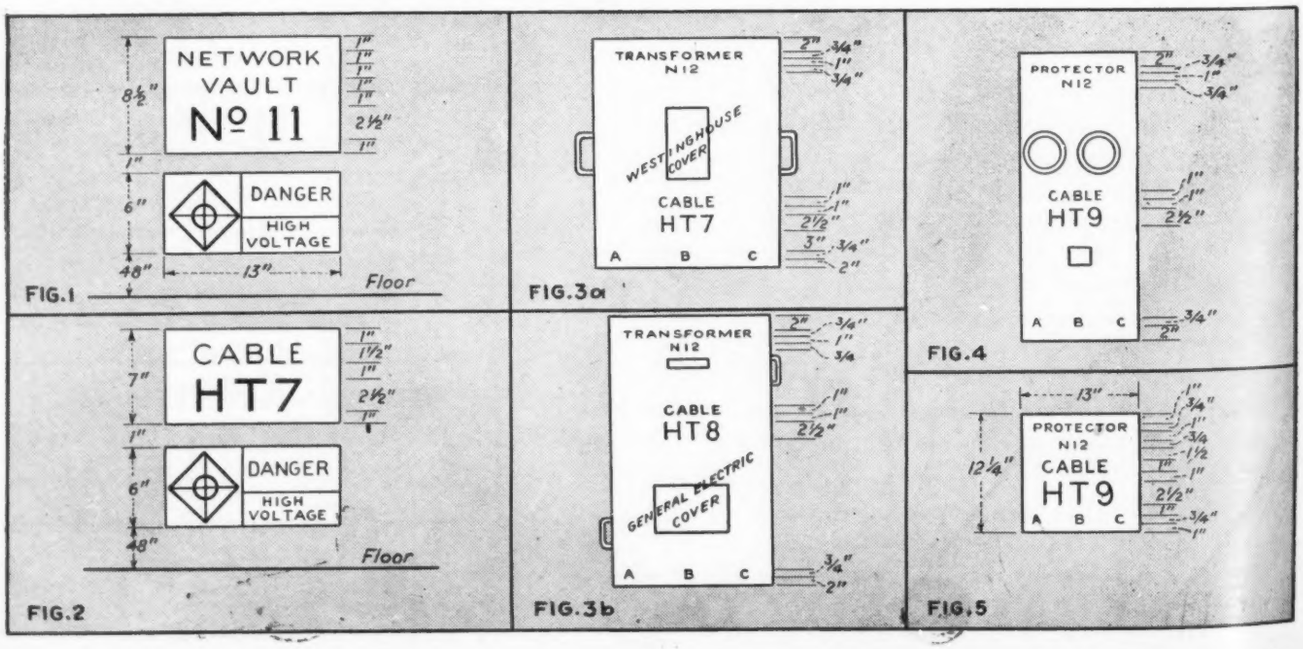
Network transformers shall be numbered consecutively like other distribution transformers except in a special series with the preface "N." The number of the transformer, the number of the cable to which the primary of the transformer is connected, and the phase designation of the conductors as they would be seen if the cover were removed, shall be stencilled on the cover of the grounding switch as shown in Fig. 3a and 3b. White letters shall be used on the regular dark gray of the transformer case. The transformer number shall be stencilled at the top center using ¾-in. letters. The cable designation shall be stencilled immediately below the name plate using 1-in. letters for the word "Cable" and 2½-in. letters for the cable designation. The phase designation shall be at the bottom, widely separated as shown, using ¾-in. letters. All stencilling shall be done in such a fashion that it is not likely to be disturbed when the cover to the grounding switch compartment is removed.

Protectors

Network protectors shall be numbered with the same numbers as the transformer to which they are connected. If more than one protector is connected to a transformer, each protector will bear the transformer number with letter, A, B, C, etc.

On subway type protectors the number of the protector, the number of the cable to which the primary of the transformer is connected, and the phase designation of the secondary cables as seen when facing the protector shall be marked on the front of the case as shown in Fig. 4. White letters shall be used on the regular black of the protector case. The protector number shall be marked at the top center using ¾-in. letters. The cable designation shall be marked near the middle of the case using 1-in. letters for the word "Cable" and 2½-in. letters for the cable designation. The phase designation of the secondary cables shall be stencilled at the bottom, using ¾-in. letters.

On open type protectors the same information shall be stencilled on the wall directly above the protector or, if space is not available there, directly below it. Same size of letters, background and outline shall be used (Fig. 5) as described for subway protectors.

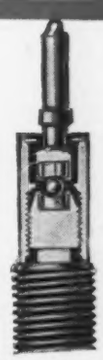


You can count on the

I-30

FOR A GOOD BEARING SYSTEM

YOU get stable torque-friction and accurate measurement, even during light-load periods, with the I-30 watthour meter, because its bearings are constructed of cobalt-tungsten. The oxides formed in the natural process of wear of this unique alloy are nonabrasive. Softer than hardened steel, cobalt-tungsten cushions shock and vibration upon the jewel bearing. And yet this alloy, first developed by General Electric, is elastic enough to withstand, without permanent alteration of shape, the pressure put upon it.

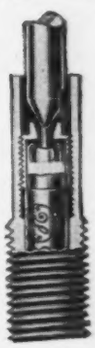


Ball-type Bearing

BOTH PIVOT AND BALL TYPE BEARINGS AVAILABLE*

The pivot-type bearing, with its oil-tight reservoir, is an exclusive feature of the I-30. Its self-lubrication reduces maintenance costs to the minimum.

The ball-type construction, with the bearing enclosed, is also an exclusive G-E design. It simplifies maintenance, test, and shop operations. Install the I-30, with cobalt-tungsten bearings, for economical and accurate metering. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*



Pivot-type Bearing

*Time-tested sapphire-jewel bearings are used in both designs.

WATTHOUR METERS

Headquarters for Electrical Measurement

GENERAL ELECTRIC

601-18-6110

How to Make Transpositions In Single-Circuit Lines

Methods of making transpositions in three-phase, three-wire transmission lines of conventional flat type and the newer wishbone type of construction are adapted from the new "Handbook for Construction of Electrical Supply Lines," of the Wisconsin Power & Light Co.

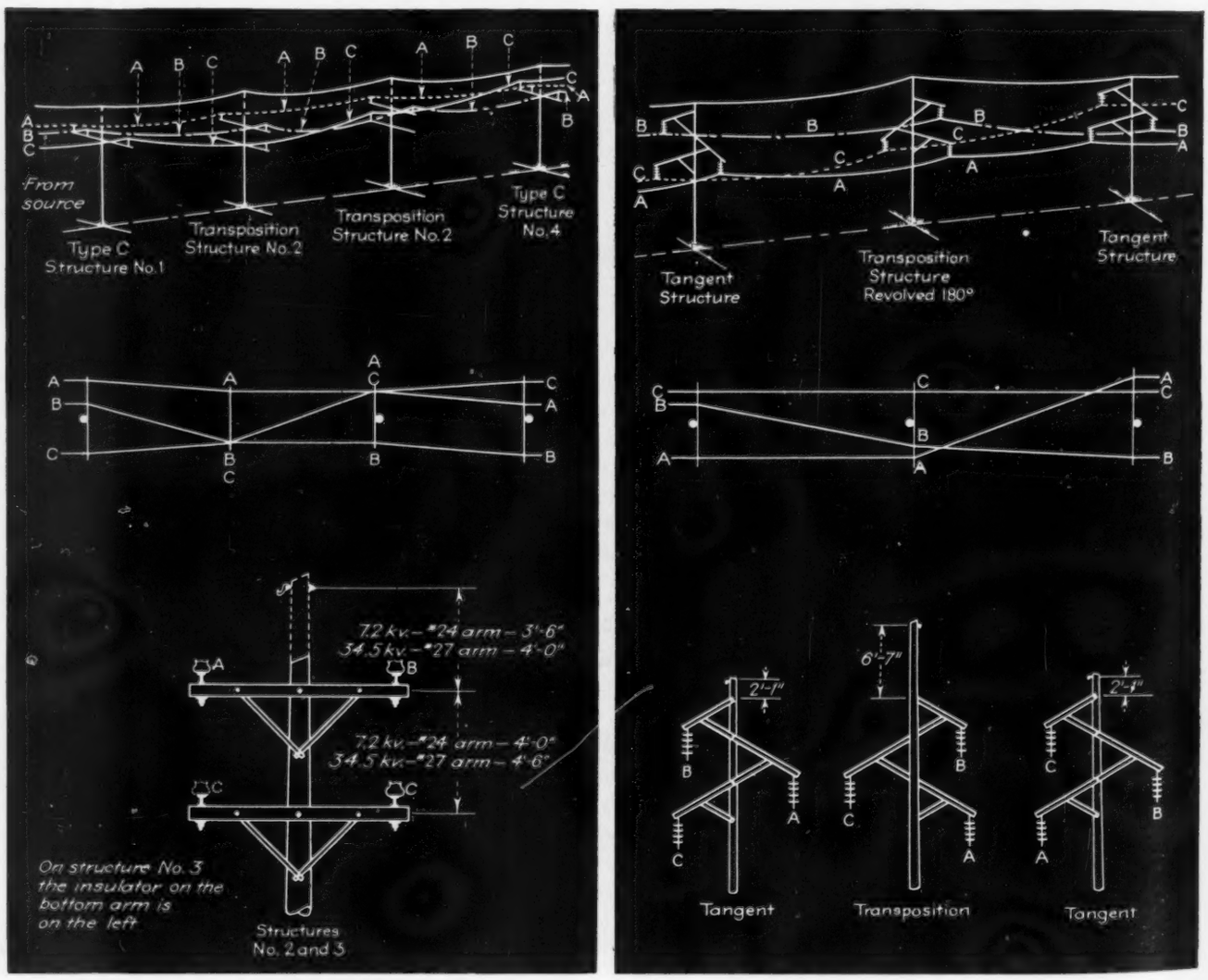
TRANSPOSITIONS are placed in transmission lines primarily to prevent disturbances in adjacent parallel telephone and telegraph lines. Usually the number of barrels and transposition locations is determined in cooperation with the communication companies concerned. This is advisable so that the transpositions in a supply line will be coordinated with the transpositions in adjacent communication lines to nullify the effects of inductive coupling between the two lines to the greatest practical degree.

The so-called non-continuous system of transposition requires only two transposition points in a "barrel", as shown in the accompanying sketches. Generally supply line transpositions are located opposite the balance points in the communication company's transposition system.

Transpositions are rolled to the right facing the direction of structure numbering.

Poles for structures No. 2 and 3 require poles 5 ft. longer than adjacent poles unless required clearance to ground is obtained in some other way.

Spans in transpositions should not exceed average spans.



TRANSPOSITIONS for conventional flat type (left) and wishbone type construction (right)

SELF-SUPERVISION PLUS

NOW CONFIRMED BY 7 Years of Service

Ratings: Low pressure, 10 to 40 kv; Medium pressure, 40 to 69 kv.

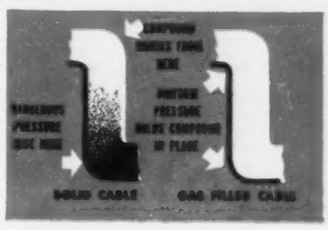
CABLE THAT SHOUTS WHEN IT'S HURT. Any break in the sheath of G-E gas-filled cable operates a pressure relay and sounds an alarm. Seven years of service experience has shown that practically all breaks can be located and repaired before service is interrupted. The pressure-regulating system has been proved simple and successful.

"FIRST AID" BUILT IN. Controlled internal pressure in gas-filled cable levels out the stress on the sheath. Should falling pressure signal a leak, service can often be maintained by valving additional gas into the system, preventing penetration of moisture or other damage until a time when repair is practical.

MORE POWER THROUGH ANY DUCT. Uniform gas pressure means more uniform quality of insulation, permitting less insulation than is required in solid-type cable. The result is a conductor of higher current-carrying capacity for the same over-all diameter, or a smaller over-all diameter for the same conductor size. In one important installation, this made it possible to use present ducts and yet meet the need for increased capacity.

		GAS	SOLID
INSULATION THICKNESS (in inches)	15 Kv	.140	.203
	27 Kv	.240	.297
	40 Kv	.350	.422
OUTSIDE DIAMETER 3 Cond., 27 Kv (500,000 cir mils)		2.80	3.05

INSULATING COMPOUND CAN'T SLIDE DOWN HILL. Because little or no excess compound is present, there's no tendency for compound migration to strain the sheath at the bottom of grades or risers, or for insulation to dry out at the top. Gas pressure and insulation remain uniform. Successful installations include risers of more than 200 feet.



● Within its recommended voltage ranges, gas-filled cable offers the lowest long-term over-all cost (installation plus maintenance). It handles higher emergency overloads with lower internal stresses than solid-type cable. For full information, ask for Bulletin GEA-3652. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GAS-FILLED CABLE

GENERAL ELECTRIC

Spectral Emissivities Of Oxidized and Unoxidized Surfaces

THOMAS R. HARRISON, Technical Adviser, The Brown Instrument Co., Philadelphia, Pa.
(A Division of Minneapolis-Honeywell Regulator Co.)

WHEN an optical pyrometer is used to measure the temperature of a heated object not surrounded by walls heated to the same temperature, usually a correction should be applied depending upon the spectral emissivity of the surface of the object. Tables of spectral emissivities, applying for a narrow band of wavelengths in the vicinity of 0.65μ as usually employed by optical pyrometers, for oxidized and unoxidized substances often involved in industrial measurements are presented here.

A table for the determination of optical pyrometer corrections corresponding to various spectral emissivities and comparison with the corresponding corrections for radiation pyrometers are discussed elsewhere*.

Spectral emissivity is defined as the ratio of the rate at which radiant energy within a particular narrow wavelength interval is emitted from unit area of a given substance to the rate at which radiant energy within the same wavelength interval is emitted from unit area of a blackbody at the same temperature. This ratio for the usual optical pyrometer is indicated by $e_{0.65\mu}$. For a blackbody $e_{0.65\mu} = 1$.

A blackbody is a radiator which, at any specified temperature, emits radiant energy at each wavelength at maximum rate possible for any radiator as result of temperature alone.

Except as noted, the following tables were prepared by W. F. Roeser and H. T. Wensel of the Pyrometry Section of the National Bureau of Standards and are taken from the appendix of "Temperature, Its Measurement and Control in Science and Industry" (American Institute of Physics, 1941), Reinhold Publishing Company, New York. Values for the stainless steels at end of second table are from curves by George N. Goller, "Trans. A.S.M.," Vol. 32, pages 239-49, (1944).

* *See "Journal of the Optical Society of America," Vol. 35, pages 706 and 708, November, 1945, and "Instrumentation," Vol. 1, page 7, July and August, 1945.*

Spectral Emissivities of Oxides

MATERIAL	EMISSIVITY, $e_{0.65\mu}$ RANGE OF OBSERVED VALUES	EMISSIVITY, $e_{0.65\mu}$ PROBABLE VALUE FOR THE OXIDE FORMED ON SMOOTH METAL
Aluminum Oxide	0.22–0.40	0.30
Beryllium Oxide	0.07–0.37	0.35
Cerium Oxide	0.58–0.80	....
Chromium Oxide	0.60–0.80	0.70
Cobalt Oxide	.....	0.75
Columbium Oxide	0.55–0.71	0.70
Copper Oxide	0.60–0.80	0.70
Iron Oxide	0.63–0.98	0.70
Magnesium Oxide	0.10–0.43	0.20
Nickel Oxide	0.85–0.96	0.90
Thorium Oxide	0.20–0.57	0.50
Tin Oxide	0.32–0.60	....
Titanium Oxide	.....	0.50
Uranium Oxide	.....	0.30
Vanadium Oxide	.....	0.70
Yttrium Oxide	.....	0.60
Zirconium Oxide	0.18–0.43	0.40
Alumel (oxidized)	.....	0.87
Cast Iron (oxidized)	.....	0.70
Chromel P (90 Ni-10 Cr) (oxidized)	.....	0.87
80 Ni-20 Cr (oxidized)	.....	0.90
60 Ni-24 Fe-16 Cr (oxidized)	.....	0.83
55 Fe-37.5 Cr-7.5 Al (oxidized)	.....	0.78
70 Fe-23 Cr-5 Al-2 Co (oxidized)	.....	0.75
Constantan (55 Cu-45 Ni) (oxidized)	.....	0.84
Carbon Steel (oxidized)	.....	0.80
Stainless Steel (18–8) (oxidized)	.....	0.85
Porcelain	0.25–0.50	....

Spectral Emissivities of Materials, Surface Unoxidized

MATERIAL	TEMP., DEG. C.	EMISSIVITY, $e_{0.65\mu}$ SOLID STATE	EMISSIVITY, $e_{0.65\mu}$ LIQUID STATE
Beryllium	.....	0.61	0.61
Carbon	.....	0.80–0.93	....
Chromium	.....	0.34	0.39
Cobalt	.....	0.36	0.37
Columbium	.....	0.37	0.40
Copper	.....	0.10	0.15
Erbium	.....	0.55	0.38
Gold	.....	0.14	0.22
Iridium	.....	0.30	....
Iron	.....	0.35	0.37
Manganese	.....	0.59	0.59
Molybdenum	.....	0.37	0.40
Nickel	.....	0.36	0.37
Palladium	.....	0.33	0.37
Platinum	.....	0.30	0.38
Rhodium	.....	0.24	0.30
Silver	.....	0.07	0.07
Tantalum	.....	0.49	....
Thorium	.....	0.36	0.40
Titanium	.....	0.63	0.65
Tungsten	.....	0.43	....
Uranium	.....	0.54	0.34
Vanadium	.....	0.35	0.32
Yttrium	.....	0.35	0.35
Zirconium	.....	0.32	0.30
Steel	.....	0.35	0.37
Cast Iron	.....	0.37	0.40
Constantan	.....	0.35	....
Monel	.....	0.37	....

MATERIAL	TEMP., DEG. C.	EMISSIVITY, $e_{0.65\mu}$ SOLID STATE	EMISSIVITY, $e_{0.65\mu}$ LIQUID STATE
Chromel P (90 Ni-10 Cr)	.....	0.35	....
80 Ni-20 Cr	.....	0.35	....
60 Ni-24 Fe-16 Cr	.....	0.36	....
Alumel (95 Ni; Bal. Al, Mn, Si)	.....	0.37	....
90 Pt-10 Rh	.....	0.27	....
Stainless Steel			
27 Cr, or 18–10 Cb and Ti	2,750	....	0.64
	2,875	....	0.69
	3,000	....	0.75
16 Cr	2,750	....	0.59
	2,875	....	0.65
	3,000	....	0.70
12 Cr, or 16–2	2,750	....	0.56
	2,875	....	0.62
	3,000	....	0.67
27–20	2,750	....	0.51
	2,875	....	0.56
	3,000	....	0.62
18–9 Sulphur	2,750	....	0.44
	2,875	....	0.49
	3,000	....	0.54
12 Cr Sulpnur	2,750	....	0.39
	2,875	....	0.44
	3,000	....	0.50
18–9 Se	2,750	....	0.37
	2,875	....	0.43
	3,000	....	0.48

THESE G-E SELLING TOOLS WILL HELP YOU PROMOTE *Adequate wiring*

Most of the customers you serve will readily admit that adequate wiring is both important and desirable—but it takes more than *acceptance* to get *action*.

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ADEQUATE WIRING FOR INDUSTRY—This manual of modern methods and materials is invaluable in assisting your power salesmen to make practical suggestions for worthwhile improvements in industrial wiring systems. It contains data on wiring system layout, examples of how wiring can be improved, and convincing facts to make the story of adequate wiring easy to present in terms of profit to your customers.

FARM WIRING GUIDE—New material is presented here in clear, easy-to-understand form. It covers every angle of farm wiring from the smallest tool shed to the largest cow barn. This booklet is something you can *talk over* with your power users, to show why adequate wiring benefits them. It is full of illustrations, charts, diagrams, and helpful suggestions.

THE POOR WIFE'S REVENGE—We call this "A Picture Book for Grown-ups" because it tells in amusing fashion of the trials and tribulations that can so easily beset any family with an inadequately wired home. Here's an easy way to help your customers to remedy the faults that take the joy out of true "electrical living"—and hinder the normal growth of your power loads.

GENERAL ELECTRIC

SECTION AW-663-9
APPLIANCE AND MERCHANDISE DEPARTMENT
General Electric Company
Bridgeport, Connecticut

Please send me:

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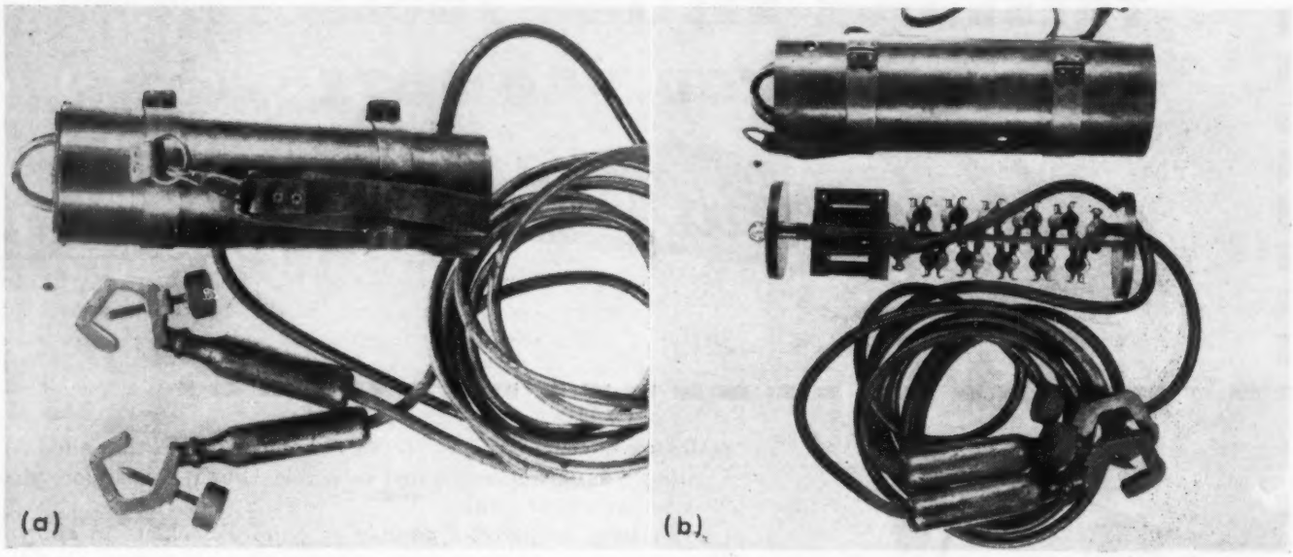
- ☐ Adequate Wiring for Industry
- ☐ Farm Wiring Guide
- ☐ The Poor Wife's Revenge

Name_____

Address_____

Primary Circuit Tester



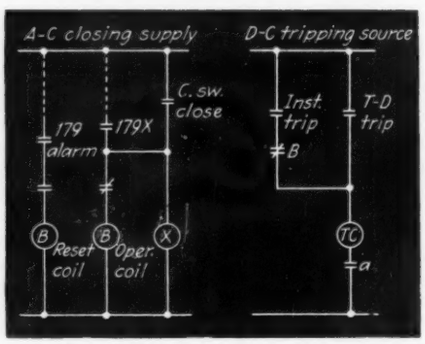
TO TEST 4,800-V. CIRCUITS for normalcy, grounds, phasing, and to check a dead line, the Detroit Edison Co. has provided line crews with the illustrated (a) primary test set. It consists of ten 25-watt, 40,000-ohm resistors in series with the primary winding of a 700/3.3-v., 3-watt transformer the secondary of which is connected to a 3-cp., 6.8-v. double-contact bayonet-base lamp. The lamp is mounted in the end of a bakelite tube of 4-in. diameter, 13 in. long. Resistors and the transformer as shown (b) are mounted in the tube and leads are brought out through its sides. The tester is used as a voltmeter; the lamp gives an indication of the voltage on the circuit under test

• • • • • • •

Instantaneous Trip Blocking on A.C. Supply

OLIVER RAMSAUR
Control Equipment Engineer,
Pennsylvania Power & Light Co.,
Allentown, Pa.

WITH automatic reclosing of feeder circuit breakers equipped with both time and instantaneous overcurrent relays, recent practice is to block the instantaneous trip after the first trip-out, to give the transformer or branch fuses time to blow if the fault is permanent and not on the main feeder. The usual method of blocking has been by the use of an auxiliary relay whose back contact controls the instantaneous trip and whose coil is paralleled with the recloser motor, so that the instantaneous trip can function only when the recloser is at rest.



AUXILIARY RELAY for automatic reclosure of feeder circuit breaker

This scheme is quite satisfactory with d.c. control; but with a.c. control the closing power is usually taken from the same source as the feeder, and reclosure on a close-up fault may so reduce the supply voltage that the blocking relay will drop out and restore instantaneous tripping, thus defeating the purpose of the blocking.

To overcome this, the scheme shown in the elementary diagram has been devised. The blocking relay B is an auxiliary relay of either the toggle or latch-in type, whose operating coil parallels the coil of the closing relay X and whose reset coil is energized by the alarm contact of the recloser in the lock-out position. A back contact of B controls the instantaneous trip; and a front contact of B prevents burn-out of the reset coil if the recloser locks out due to unsuccessful reclosure and keeps its alarm contact closed indefinitely.

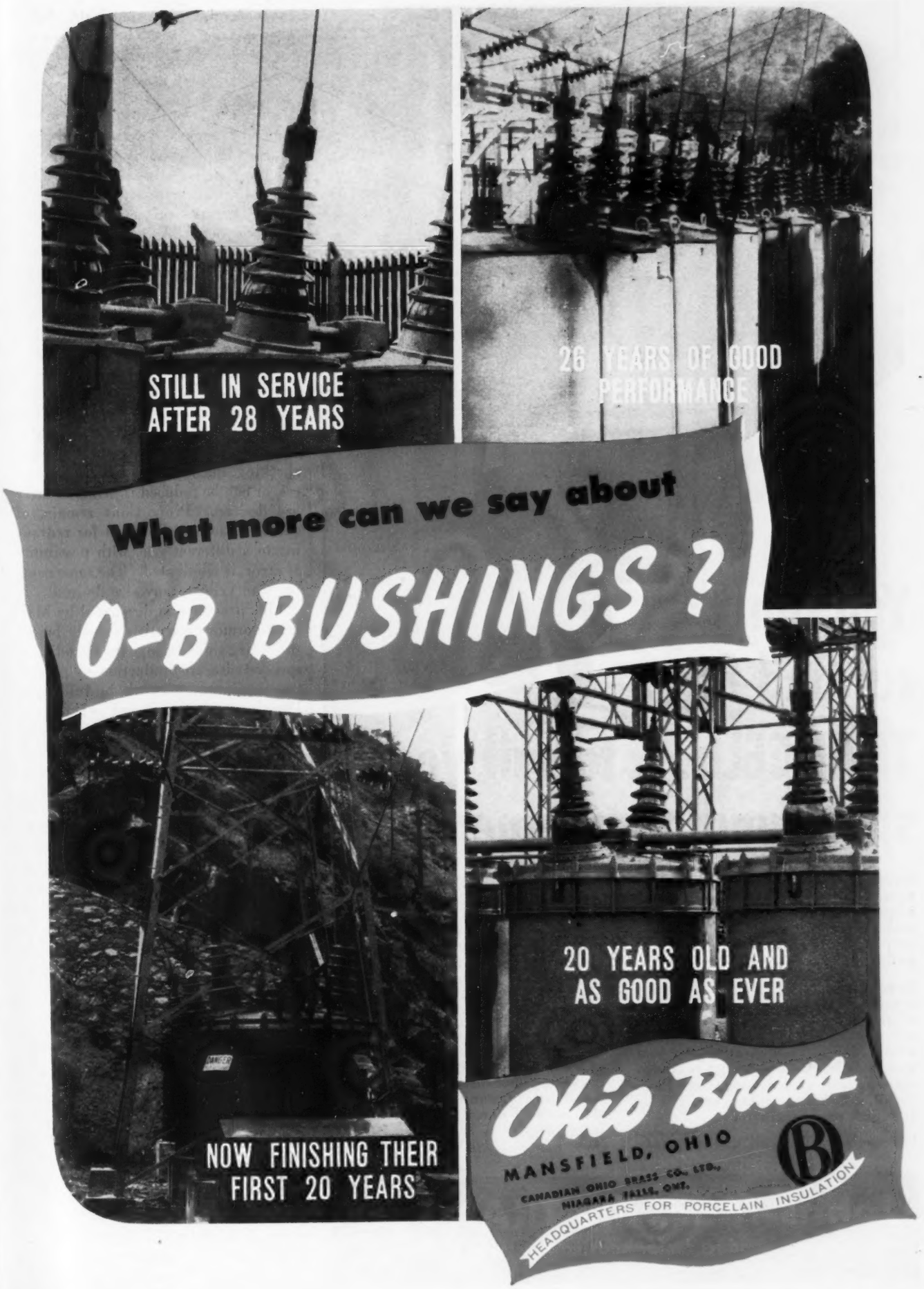
To prevent latching up the blocking relay for manual reclosure after breaker maintenance or following removal of a permanent fault, a normally closed contact of the control switch is employed in the operating coil circuit of the blocking relay.

• • • • • • •

Surfaces Made Usable For Photographic Prints

A PROCESS by which metal, wood, cloth, leather, plastics or almost any other surface can be made usable for photographic reproduction has been developed by The Glenn L. Martin Co., Baltimore, Md. Basis of the process is an emulsion which can be spread on the materials to sensitize them for photographic print use.

In its normal state, the emulsion is a thin jelly-like substance which, when heated to a temperature of 125 deg., becomes a liquid which may be applied to the desired surface with a camel's hair brush, a soft sponge or a soft rag. Allowed to dry, the negative is then printed on the sensitized surface and development proceeds normally as if it were a commercial paper. All operations are carried out under dark-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Johns-Manville supplies Trancell cut to special dimensions, or, if you prefer, you may cut it in your own plant as most maintenance departments do . . . saving shut-down time, numerous detail drawings and materials. For full details, write Johns-Manville, Box 290, New York 16, N. Y.

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an asbestos product . . . for housing electrical equipment

room conditions, using ruby lights. The emulsion may be heated any number of times without affecting its efficiency or printing qualities.

After printing, the metal, wood or plastic prints are developed in the same manner as any commercial photo paper. Either line drawings or continuous tone negatives can be printed, by projection or contact. Pictures possible under the process are restricted to black and white prints but can be hand tinted with transparent oils. Prints on metal or wood can be proofed against weather by a lacquer or varnish finish. Many of the signs around the Martin plants have stood the ravages of weather for five years or more.

In industry the process will have its uses in the reproduction of drawings for manufactured products or machinery. Such drawings can be either to full scale for ease in reading and checking during manufacturing process, or can be reduced if prints to carry are desired. Proportions remain, of course, exact and the need for redrawing to a different size, with possibility of error, is eliminated. The same negative can print to any size desired.

This process was developed by Martin laboratory scientists shortly before the war and during the conflict it speeded aircraft production by permitting engineers to work in full scale. Drawings were projected rapidly and in number directly on metal, wood and plastic surfaces. These were then used for reference, fill-in, tooling (tools could be built directly on the templates), inspection tools and for cutting out pieces for experimental aircraft directly from the drawings projected on the rigid surfaces. Savings thus effected in aircraft engineering and production were enormous and the system was used widely throughout the aircraft industry.

•

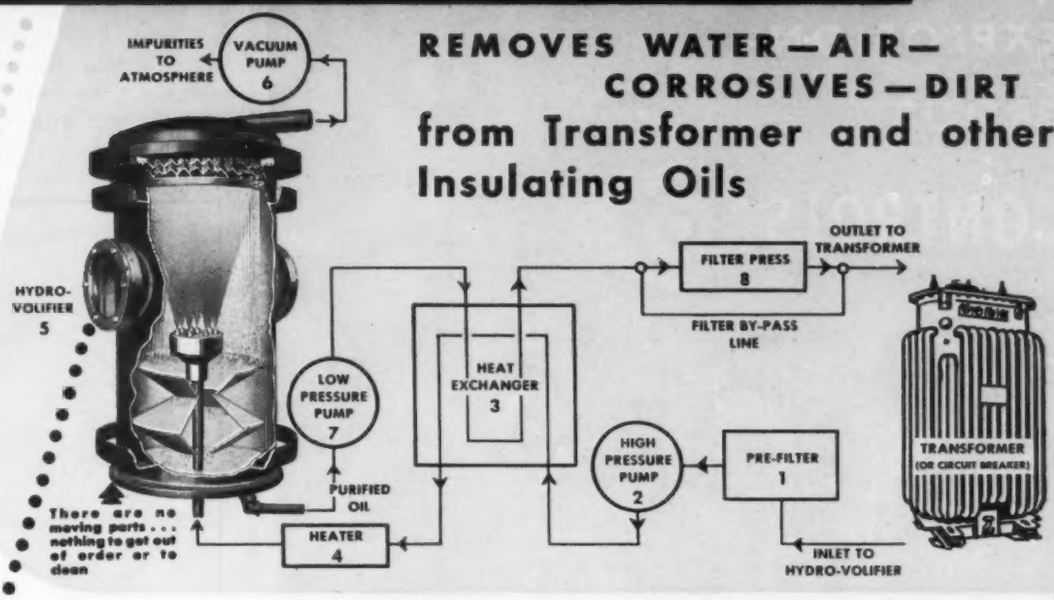
Reflector on Pole Butt Makes Night Hauling Safer

JAMES McKENZIE
Philadelphia Electric Co.

OCCASIONALLY emergencies occur which necessitate pole hauling after dark. During such periods it is extremely difficult for the following motorist to see the butt-end of the pole which extends beyond the trailer.

Philadelphia Electric Co. overcomes this difficulty by attaching a 4-in. re-

IN ONE PASS . . . *the Buckeye Process*



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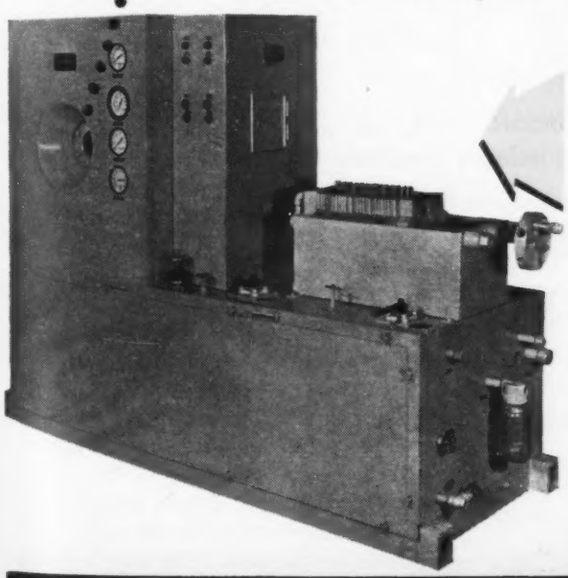
BASICALLY SIMPLE

Atomizing the oil within a sealed vacuum chamber, separates from it all volatile impurities and allows them to be discharged into the atmosphere.

Dirt . . . even of colloidal-particle size . . . is removed by the Hydro-Volifier.

The clean, purified, and absolutely *dry* oil is returned to the transformer.

Dielectric is raised as much as 200%. Service life of the oil is multiplied. Cooler transformer operation is assured without a moment's service interruption.



MECHANICALLY SOUND

The atomizer nozzles are sealed within the vacuum chamber of the Hydro-Volifier. This device is equipped with a high-pressure intake pump, a vacuum exhaust pump and a low-pressure pump for returning the purified oil to the transformer. Glass ports afford visible observation of the Process at all stages. One man can perform the entire operation. Maintenance is negligible.

Get the Facts

Bulletin 100-D illustrates and describes in detail the Buckeye Process for purifying all types of insulating, lubricating and vacuum oils. Your copy will be mailed promptly upon receipt of the attached coupon.

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A large variety of standardized explosion-proof enclosures is available for grouping and assembly of control and power units in panel form, at minimum cost and without the usual delay of special designs.

R&S Standard Enclosures have wall sections permitting a great variety of conduit arrangements and sizes to suit job requirements. This simplifies material lists and reduces inventories caused by field changes.

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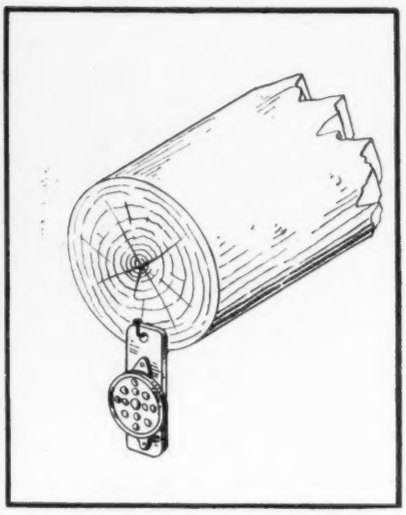
125 BARCLAY STREET · NEW YORK 7, N. Y.

flector to the pole butt. The reflector is permanently bolted to a piece of strap iron which has a small hole drilled in one end. It is attached to the pole butt by a nail inserted through the hole, pounded into the butt and then bent. This allows the reflector to swing during the hauling operation and allows the reflector to be removed from the butt without cracking the reflector.



4-IN. REFLECTOR bolted to 8-in. strap iron and nailed on pole butt reflects motorist's headlights

•

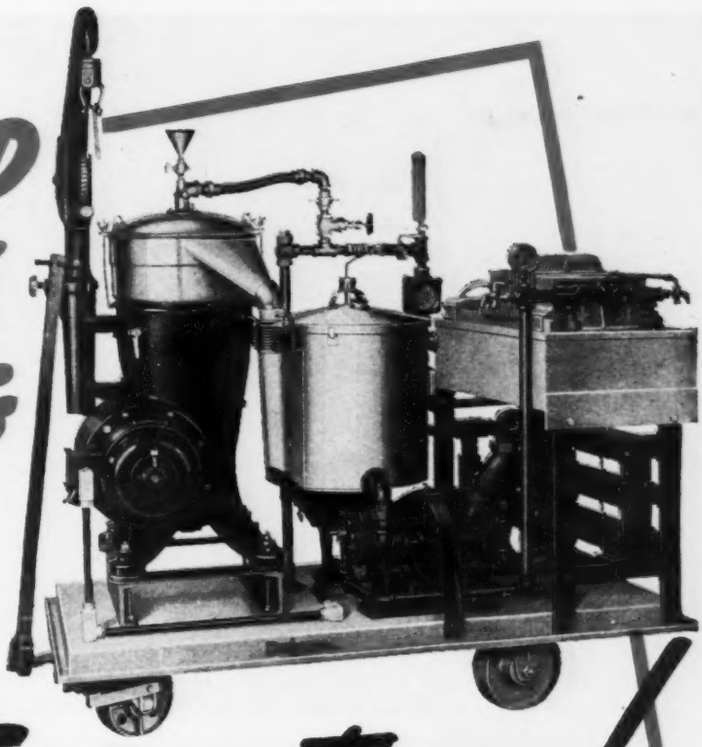
Three Devices Simplify Meter Lead Preparation

LEADS for the connection between watthour meters and connection boxes are prepared by the hundreds and carried in stock as a convenience to installers. Three simple devices are used in the meter department at Consolidated Gas Electric Light & Power Co. of Baltimore (Md.) to obtain uniformity of lead length and uniformity of loop size.

The wire is inserted through cutter inserts and is butted against an adjustable stop, set according to the length of wire required. Studs, mounted on a metal strip fastened to the table, form guides for the stop. The wire is easily cut by one stroke of the cutting blade.

A No. 8 solid rubber covered wire is standard for these leads and the insulation stripper and polisher is designed for this size. The stripper is a piece of 1-in. round steel, 3 in. long, with a hole through the center slightly larger than the over-all diameter of the wire. The insulation cutting blade is mounted on an angle to the wire in a

PURIFY AND DEHYDRATE INSULATING OIL



at Low Temperatures!

DE LAVAL Insulating Oil Purifiers dehydrate oil by centrifugal force, at low temperatures. This produces oil that is safer, more reliable than that maintained by methods demanding relatively high heat to drive off moisture. It prevents rapid reduction in dielectric strength of oil after purification. Moreover, purification by De Lavals, at relatively low temperature, eliminates the probability of condensate forming in receiving tanks.

The electric heaters on De Laval insulating oil purification equipment prevent carbonization of the oil and keep heating costs down to a minimum.

De Laval Insulating Oil Purifiers have many other advantages, such as the ability to dehydrate at a single pass, without aid of filter press (press is used only to remove colloidal carbon), and — very important — the feature of continuously discharging water, thus preventing re-contamination of the oil.

• Write for Bulletin No. 350.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

INSULATING OIL PURIFIERS

Bronze Bolts in the Sky!

Overhead Power Lines and Underground Cables of the vast American Utilities Networks depend upon hundreds of devices and accessories—from giant tower structures to tiny bolts and nuts—for uninterrupted continuity of their vital service.

G&W Potheads, for example, protect the ends of the underground cables where they connect to the overhead lines. These potheads are sealed against the weather and faithfully transfer voltage with a minimum of loss.

G&W Potheads are only one phase of utility equipment which relies upon Harper Silicon Bronze Bolts and Nuts for strength, resistance to atmospheric corrosion, elimination of "season cracking", reduction of maintenance cost.

H. M. HARPER COMPANY
2611 FLETCHER STREET
Branch offices: New York City, Philadelphia, Los Angeles, Milwaukee, Cincinnati, Dallas
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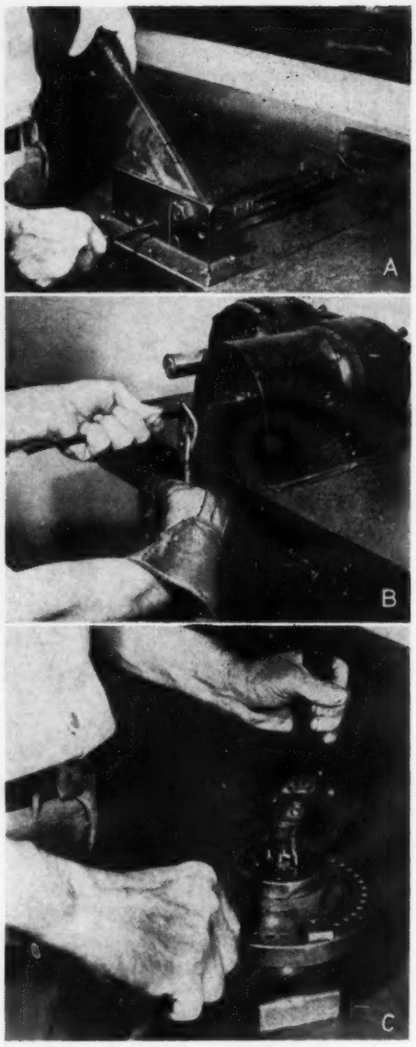
HARPER *Chicago*

Harper manufactures and maintains large stocks of Brass, Copper, Naval Bronze, Silicon Bronze, Monel and Stainless Bolts, Screws, Nuts, Washers, Nails



A—Leads cut to prescribed length
B—Leads are stripped to desired length
C—Loops are made uniform

"V" cut in the round steel and is adjusted so that it will not nick the conductor. After the wire is pushed past this blade, the conductor passes through a steel collar, tapered on its leading edge, which removes the majority of the rubber left by cutting blade. This collar also serves as a guide for the stripped conductor. About $1\frac{1}{4}$ in. of insulation is removed by this machine, which is directly attached to the shaft of a $\frac{1}{4}$-hp., 1,750-rpm. motor.

Final traces of rubber are removed and the conductor is polished by inserting it in a cylinder in which carding cloth, rolled wire-side in, is inserted. It, too, is attached to a $\frac{1}{4}$-hp., 1,750-rpm. motor. A loop is then formed at the end of the wire by a die-duplicating bender which has been fitted with a special stop so that all loops are uniform. All of this equipment has been in use several years and satisfactorily produced uniform leads.

up Prospects

lighting load with G-E Lamps

4 A GOOD MAINTENANCE MAN, like this one, burns up when he finds a high rate of lamp burnouts. Good lamps and quickly available replacements keep him happy.

YOUR G-E SALES PLUS: Customers get all the benefits of high efficiency combined with long lamp life when they get G-E Lamps. You know that G-E quality keeps lamps in use and keeps customers satisfied.

5 THIS SAFETY ENGINEER figures many a good way to cut down accidents. Wants controlled lighting—properly applied—to help workers see faster, safer, more accurately.

YOUR G-E SALES PLUS: a complete line of General Electric Lamps, backed by research that is constantly at work to make G-E Lamps ever better and to make them *Stay Brighter Longer.*

LIGHTING PROBLEM?

Call on G-E engineers. They may have a helpful new idea that will give your customers better lighting results. Why not find out?

LOAD BUILDING

Incandescent Down-Light Puts Sparkle in Jewelry

F. H. MEIER
Lighting Engineer, Consumers Power Co., Muskegon, Mich.

JEWELRY STORE LIGHTING—Surface-mounted incandescent and fluorescent units light Kay's Jewelry Store, Muskegon, Mich. Incandescent down-light controlled by prismatic control lens and reflector gives 75 foot-candles in elliptical light pattern on counter and a vertical component on wall cases. Cold cathode is used for supplementary light in wall cases

ANY MERCHANT knows that it is easy to spend money when remodeling a store. Coves and built-in or recessed light sources are beautiful to look at but they add considerably to the original cost. Not only that, but they are expensive to maintain and many types are very inefficient.

The owner of Kay's Jewelry Store, recently opened in Muskegon, Mich., wanted good practical lighting with minimum glare and maximum efficiency. It is essential in the selling of jewelry that there be plenty of light on the counter, and also a pleasing general illumination with supplementary lighting in the wall cases. After much thought, it was decided to use a down-light over the counters to produce sparkle on the jewelry, and a general light source to produce a pleasing atmosphere.

This jewelry store was lighted with both incandescent and fluorescent, using surface-mounted units. To conform the light pattern to the counter—long and narrow—a special light-controlling element was used. The optical combination of a double Holophane prismatic control lens with reflector lays down an elongated, elliptical pattern of light over the counter top and directs a vertical component on the wall cases. The elongated beam, which is directed toward the counter, is adjustable but has to be set by the manufacturer, so it is necessary to have an engineered layout based on the counter locations.

Approximately 75 foot-candles of illumination are obtained on the counter tops, using 300-watt clear lamps. The Holophane units are mounted on the 12-ft. ceiling, 5 ft. apart, and are placed on a line so that the fixture is just over the outside edge of the front of the counter. This offset mounting eliminates fixture reflection in the top of the counter glass.

Continuous glass-enclosed fluorescent units provide general light, and each 4-ft. section contains four 40-watt white fluorescent lamps. In the rear of the store where the luggage, small appliance department, and office are located, the special lens is discontinued and two rows of fluorescent units are installed. Cold cathode provides supplementary lighting in the wall cases.

A number of customers questioned upon entering the store for the first time remarked about the pleasing and cheerful appearance of the interior. Both the owner and the sales people are enthusiastic over the ease of seeing and are particularly impressed with the large amount of light on the counters and the enhanced appearance that it gives the merchandise.

•

High-Pressure Steam By Electric Heat

R. I. LAVELLE
Duquesne Light Co., Pittsburgh, Pa.

INSTALLATION of a 12-kw. electric steam generator solved the problem of furnishing high-pressure steam to a dispersion mill in the Paint Research Laboratory of the Watson-Standard Co., Pittsburgh, Pa.

The laboratory dispersion mill is one of the newest developments in modern paint research and with it the

SOMETHING *Sensational*

COMING FOR

TRANSMISSION AND DISTRIBUTION MEN

CONSTRUCTION AND ENGINEERING FIRMS . . .

COMMUNICATION COMPANIES . . . .

The problem of drilling holes for transmission, distribution and communication poles quickly, economically and with a relatively simple machine, has been solved.

A drilling unit having new and revolutionary features has been perfected and has passed severe field tests conducted by men in power and communication company staffs.

Conditions contributing to raw material supply and uninterrupted production are constantly improving and we feel confident we can tell you all about the Continental unit real soon.

CONTINENTAL

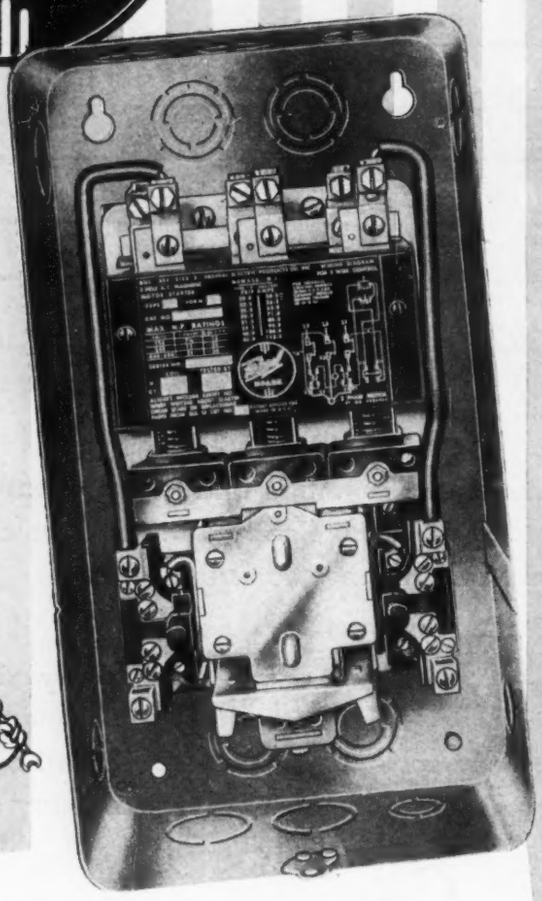
FARM MACHINE COMPANY

MANUFACTURERS OF AGRICULTURAL AND INDUSTRIAL EQUIPMENT

1124-28 METROPOLITAN LIFE BLDG. - MINNEAPOLIS 1, MINN.

Federal
NOARK

SIZE 3
MAGNETIC
MOTOR STARTER

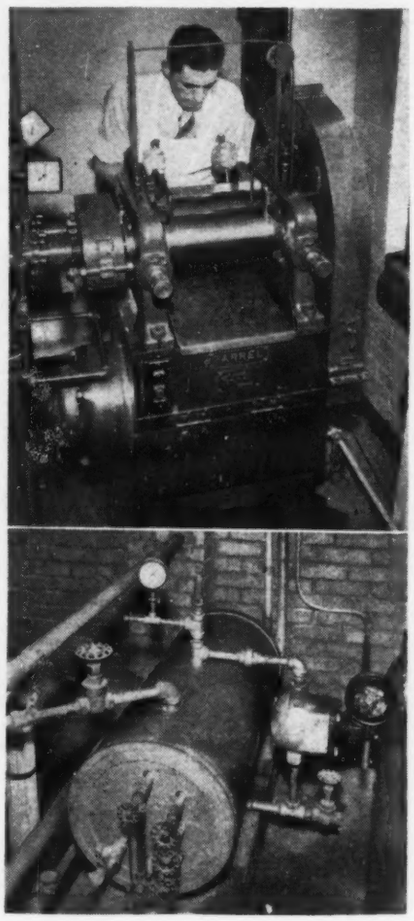


For man-size jobs of stop-and-go
Without a bit of care or woe
This starter really fills the bill . . .
A fine example of Federal's skill!

Sets a new standard of ease and speed in replacement of any stationary or moveable contacts. Coil replacement in a few seconds without disturbing line or load connections. Greater compactness, yet more ample wiring space. Silver contacts on all current interrupting points. Exclusive vertical ball-bearing operation for highest speed solenoid action. Overload relays, combination hand or automatic reset, for dependable protection.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. PLANTS: HARTFORD, CONN. NEWARK, N. J.

Watson-Standard Co. is conducting detailed research on the latest applications of plastics in protective coatings. With this new mill, the rolls of which are heated by high-pressure steam, it



THIS high-pressure generator furnishes steam up to 200 psi. for the rolls of the dispersion mill (above)

is now possible to have a continuous process of the basic material through application and final tests for serviceability.

Since the building in which the laboratory is located is heated by a low-pressure heating system, another source was required to provide high-pressure steam. A 12-kw., 200-lb. electric steam generator was installed for this purpose.

The advantages of using an electric steam generator are cited by the Watson-Standard Co.:

1. It is clean; there is no coal or ash handling, no fumes.
2. It is economical; the generator is used only when high-pressure steam is required.
3. It is easy to operate; steam is available at the "flip of a switch."
4. It is flexible; any desired pres-

Wire ahead

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications

No matter how good a man is, he can't work *ahead* of his machine. And all too frequently overtaxed, over extended, obsolete wiring chokes off low-cost electricity from an efficient operator.

Is your plant safe against this threat to production and morale?

Why not check with your plant power engineer, your consulting engineer, electrical contractor or power salesman? It may save costly shut-downs and expensive alterations later.

Today, more than ever before, full production depends on adequate wiring.

FOR FULL PRODUCTION

ANACONDA

ANACONDA WIRE & CABLE COMPANY

Utility Lamps "High Light" New York

New York—the city of skyscrapers . . . teeming traffic . . . busy thoroughfares . . . millions of pedestrians—requires the highest quality street lighting. And thousands upon thousands of UTILITY Street Lighting Lamps are faithfully providing efficient, dependable service throughout the city. Because New York recognizes UTILITY'S specialized manufacture . . . long years of research, and built-in quality. Try UTILITY Lamps in your city.

UTILITY LAMP DIVISION

McHUGH PRODUCTS

BROOKLYN, NEW YORK

SUCCESSOR TO SLATER ELECTRIC & MFG. CO.

Utility

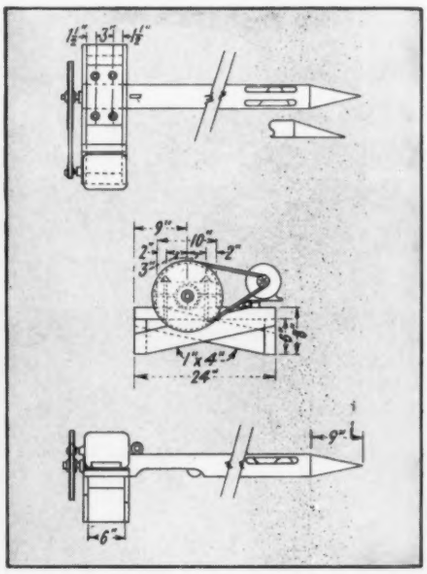
sure (up to 200 lb.) can be obtained merely by setting the control.

5. It saves floor space; the unit is compact and can be installed on a platform or an out-of-way place.

6. It is safe; the electric steam generator presents practically no fire risk and therefore reduces the over-all fire hazard. Safety devices release the pressure at a predetermined point.

•

Suggested Device For Emptying Grain Bins



DEBINNING MACHINE — A screw conveyor of the type used in domestic coal stokers is the basic element of this untried device suggested by the farm service department of Northern States Power Co. for withdrawing small grain from bins and carrying it to an elevator boot

THE SO-CALLED "debinning machine," shown, is an untried design developed by the farm service department of Northern States Power Co., Minneapolis, and is described here as an instance of efforts towards solutions of problems of applying electricity to farm work. The design suggests how small grains might be withdrawn from storage bins and carried to an elevator boot when no provision has been made for the grains to flow.

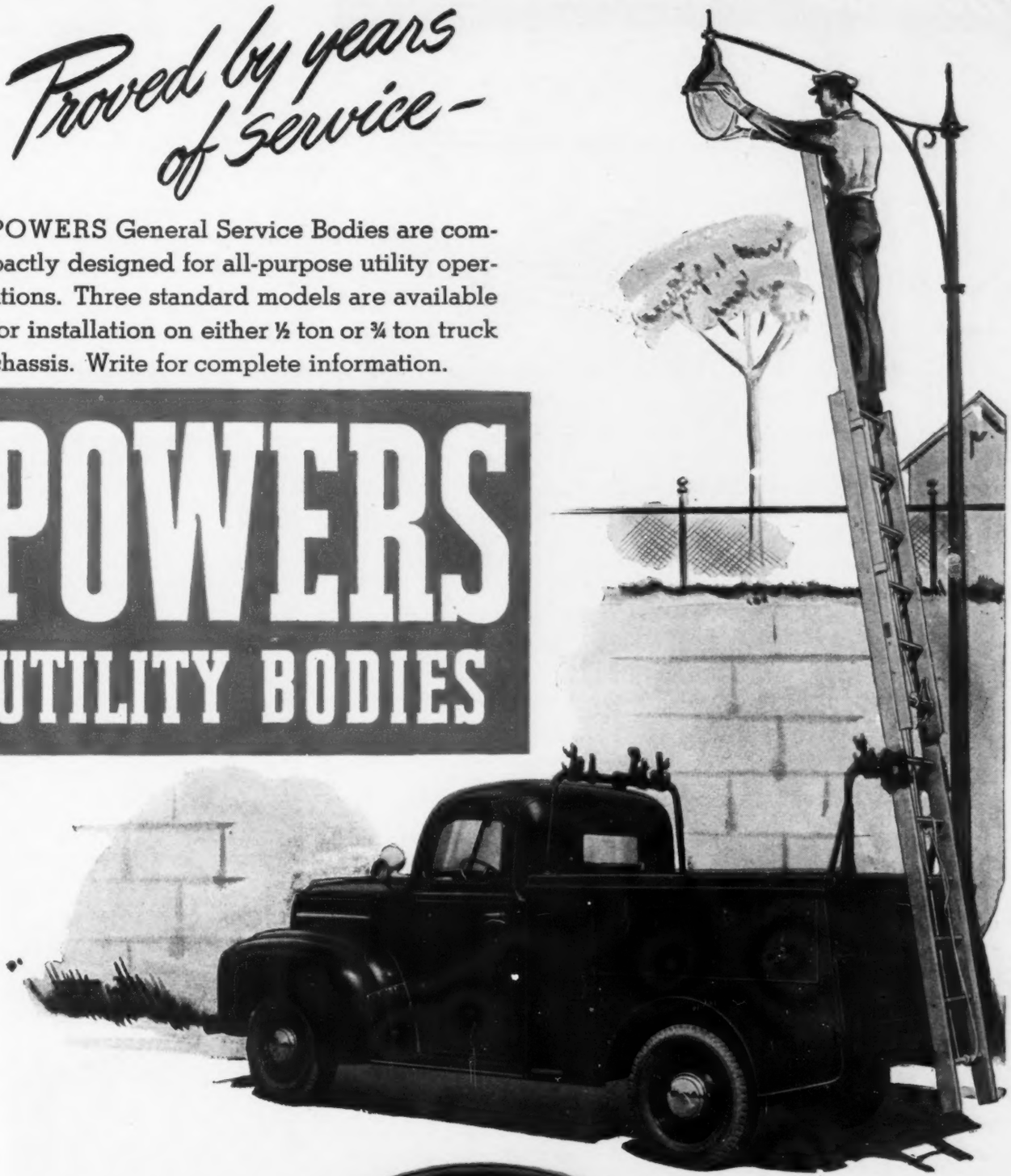
It is suggested that stoker manufacturers now have the parts necessary for the development of this type of equipment. Such parts might consist of the unit used ordinarily to withdraw coal from the storage bin and the conveyor to the stoker assembly or the spiral or

QUALITY BUILT FOR DEPENDABILITY...

Proved by years of service—

POWERS General Service Bodies are compactly designed for all-purpose utility operations. Three standard models are available for installation on either ½ ton or ¾ ton truck chassis. Write for complete information.

POWERS
UTILITY BODIES



McCABE POWERS AUTO BODY COMPANY

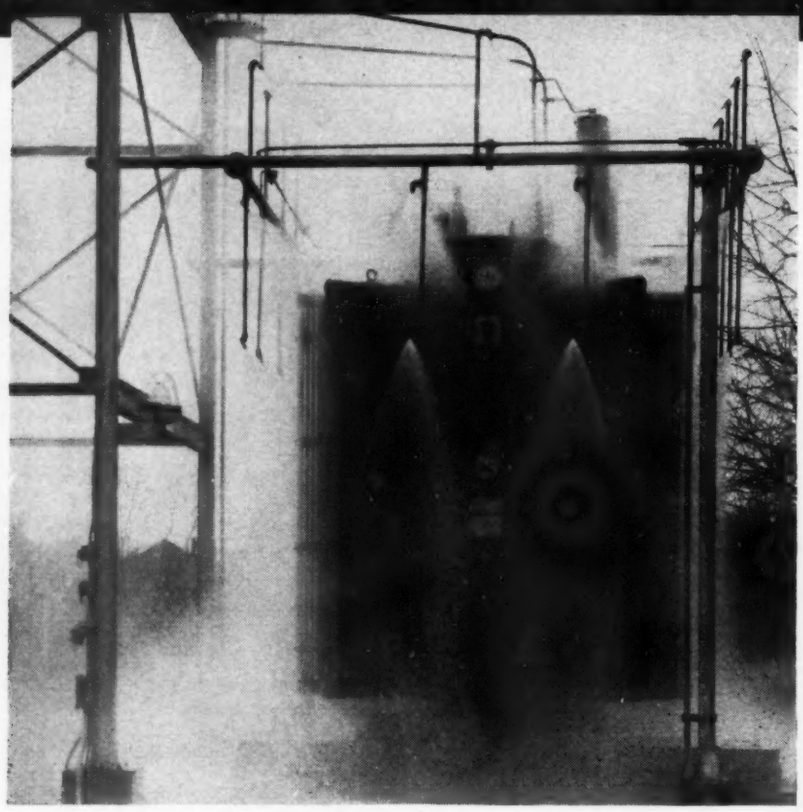
ALL-STEEL POWERS Public Utility Bodies

5900 NORTH BROADWAY, ST. LOUIS 15, MO.

LINE BODIES • POLE TRAILERS • BRUSH TRAILERS • GENERAL SERVICE BODIES

GRINNELL MULSIFYRE

Protects THE OIL FILLED EQUIPMENT OF THE WORLD'S LEADING UTILITIES



There's sound reason for the acceptance by leading utilities of Grinnell Mulsifyre Systems to protect oil filled equipment and other transformer station installations.

Executives and engineers recognize the proved principle whereby blazing oil is emulsified with a driving spray of water. The emulsion formed by the water spray is fire-extinguishing – the fire goes out in a few seconds – reignition is prevented. There is absolutely no conductivity along the discharge of Mulsifyre projectors when spray strikes high voltage conductors.

Mulsifyre Systems are permanently installed – constantly on guard with automatic operation, or may be operated manually. Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard.

Profit by the world-wide record of Mulsifyre efficiency – see that your equipment has this 24-hour protection – don't wait for fire to strike! Experienced Grinnell engineers will help you plan protection for your specific needs.

GRINNELL COMPANY

Executive Offices, Providence 1, R. I.
Branch offices in principal cities.

GRINNELL *Mulsifyre*

AUTOMATIC FIRE PROTECTION

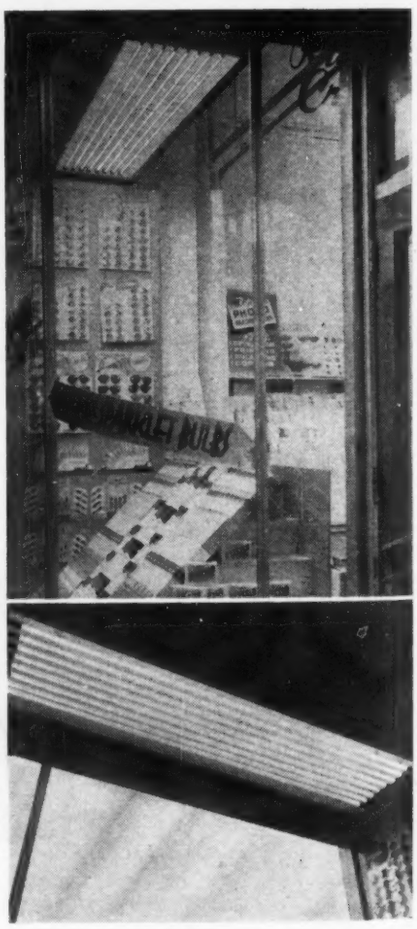
"screw" conveyor that carries coal to the fire pit.

The drawing of the suggested debinner shows the motor belted direct to the conveyor unit. This may not be possible since the speed may be too great.

Success of a unit of this type depends on the solution of two problems. The first is how to avoid overloading the device. This must be avoided by careful selection of the proper size openings through which the grain flows to the conveyor. The second problem is how to push the conveyor through a door in the bin into the grain itself. This should not be difficult if a point is provided on the end of the conveyor, as shown.

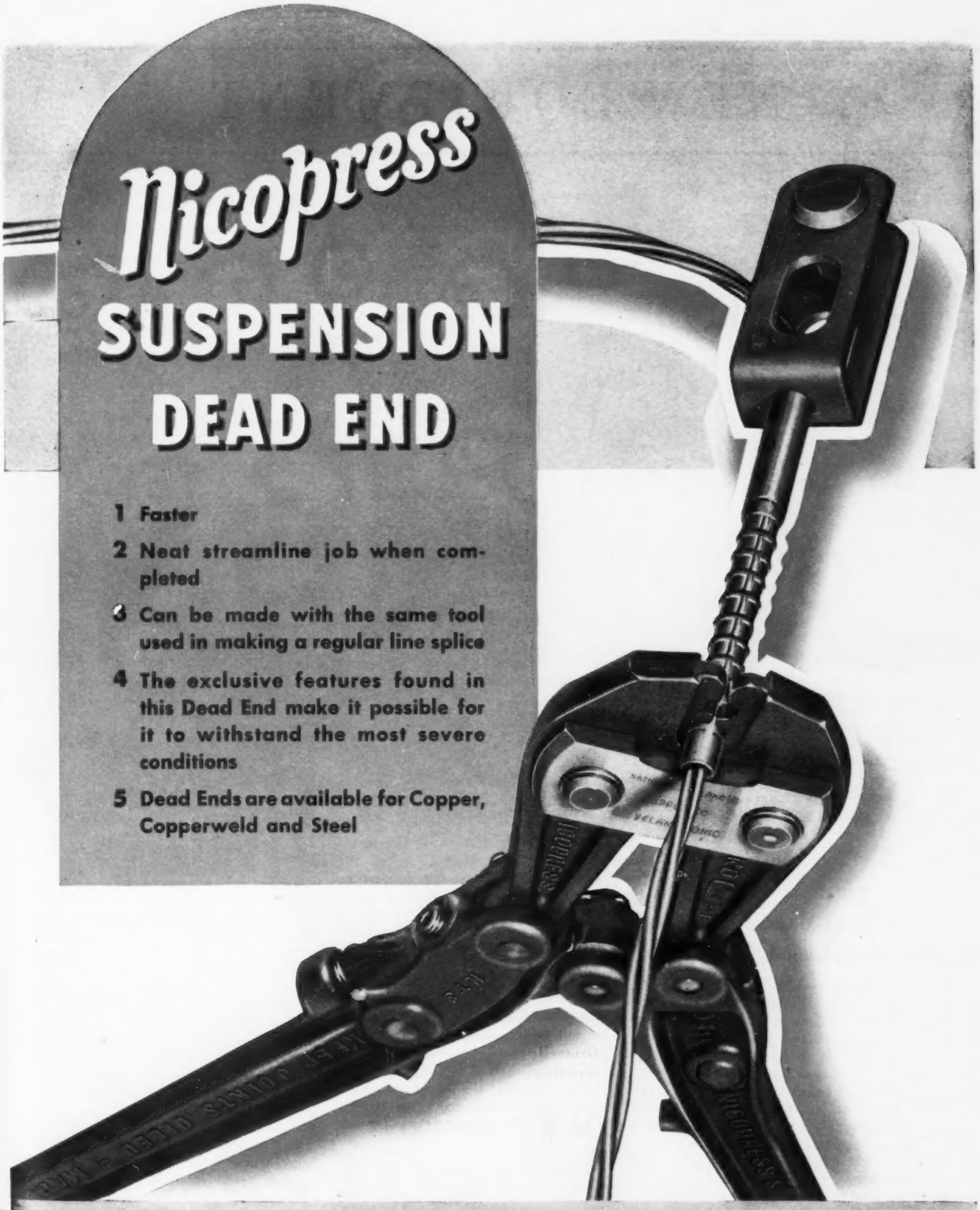
•

Fluorescent Window Lighting Unit



EIGHT 8-ft., 40-watt Colovolt cold cathode tubes in flat, flush-mounted ceiling unit provide high-intensity lighting for drug store show window in Spokane. A similar type of unit has also solved the lighting problem in each of several dentists' office laboratories in Spokane

Nicopress
SUSPENSION DEAD END



1 Faster

2 Neat streamline job when completed

3 Can be made with the same tool used in making a regular line splice

4 The exclusive features found in this Dead End make it possible for it to withstand the most severe conditions

5 Dead Ends are available for Copper, Copperweld and Steel

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

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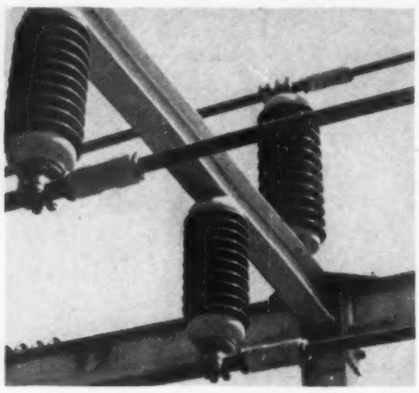
THE NATIONAL TELEPHONE SUPPLY COMPANY

NEW EQUIPMENT

Streamline Bus Connector Creates Pressure by Wedges

To ASSIST in designing stream line buses, Thomas & Betts Co., Inc., 30 Butler St., Elizabeth 1, N. J., has designed a new connector. It utilizes the old principle of creating pressure by using wedges.

Jam nuts at each end push against cone-shaped wedges. These, when tightened,



create sufficient pressure between the connector body and the copper tubing to form a resultant connection which is reported to run 20 deg. F. cooler than the tubing, the manufacturer reports. Care is taken in making the joint to provide space between the copper tube ends which will allow for metal flow during the take-up operation.

Connectors are made of a special heavy bronze and are available to accommodate ½-in. to 6-in. I.P.S. copper tubing.

•

New Permanent-Magnet Materials Announced

FIVE new permanent-magnet materials, known as Cunico, Cunife, Vectolite, Alnico 12 and Silmanal, have been announced by the General Electric Co. These new materials have many applications in the manufacture of instruments, as well as other industrial uses where small, lightweight magnets formed in intricate shapes are required.

Cunico is an alloy of copper, nickel and cobalt. Cunico magnets are made from rod, strip or wire stock, and are furnished only in their final shapes because they are age-hardened in the manufacturing process. Cunico is malleable, ductile and machinable, permitting the manufacture of small magnet screws from this material by ordinary screw machine methods, and the punching of intricate magnet shapes.

Cunife is a copper-nickel-iron alloy which has all the physical properties of cunico, differing in that it has directional properties and must be magnetized only along the direction in which the material has been cold-worked, to obtain highest magnetic quality. Cunife magnets are made from wire stock in round, square or rectangular form. In addition, cunife wire can be flattened to make thin, narrow shapes. A wide variety of magnet designs can be obtained by forming, drawing, punching or machining cunife to shape.

Vectolite is reported as the first non-metallic, non-conducting magnet material ever made. It is a hardened, sintered combination of iron rust and cobalt oxide, mixed when still in powder form. Vectolite magnets are light, being non-metallic, and their non-conductive properties prevent electrical losses caused by conduction of current. In addition, they have a high coercive force, or resistance to demagnetizing forces.

Alnico 12 is made up of aluminum, nickel, cobalt, iron and titanium. Magnets made from this material can be used in such applications as in tachometer generators and electronic devices. Alnico 12 magnets are cast, and must be ground to shape.

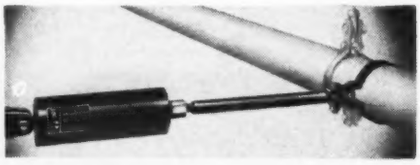
Silmanal has a high intrinsic coercive force, which makes magnets made from this material useful in instruments where service in strong electrical fields is required. Silmanal is ductile and malleable and can be punched, machined, rolled, or ground. Because of its ductility, silmanal can be made in rod, strip or wire form.

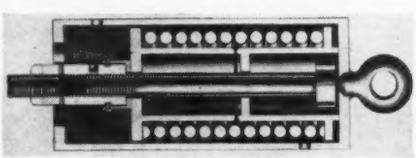
•

Sway Brace Solves Pipe Sway Problems

"SWAY BRACE" is a product developed by Grinnell Co., Inc., 260 West Exchange St., Providence 1, R. I., to be used in supporting pipe where sway due to vibration is a problem. It consists of a welded steel casing containing a spring. The casing is provided with a means of anchoring one end to a fixed point. A thrust rod connects the other end to the load, either directly or by exterior pieces to suit individual needs.

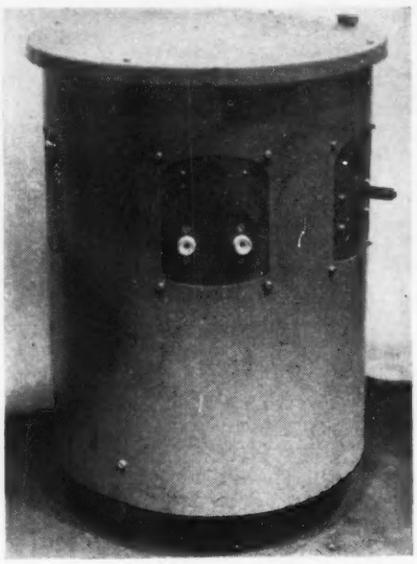
The spring is precompressed in the casing and confined between thrust plates. The thrust rod acts on these thrust plates so that a push or pull on the rod is resisted by the spring. The amount of the initial resistance is determined by the preloading of the spring and can be made to fit customers' conditions.





Brazer Unit Small Diameter Allows Lowering Into Manhole

DESIGNED for general brazing service, a new 20-kva. portable brazer with water-cooled tongs is announced by the Westinghouse Electric Corp., Pittsburgh 30, Pa. Enclosed in a circular steel housing, the entire unit is self-contained, having a contactor for energizing or deenergizing the brazing circuit, an adjustable heat brazing transformer, and a water-cooling system for the tong cooling water. Diameter is kept small (24 in.) so that it can be lowered through



hatches, water-tight doors, and manholes. A clamp type entrance bushing is provided on rear of the brazer for the incoming primary cable. The unit is used on a 220- or 440-volt circuit.

The control panel, built into the front of the brazer, contains a control switch, outlets for brazing cables, receptacle for foot switch pilot cable, and voltage tap changing plug. The foot switch, which controls the length of time during which current is applied, is provided with a length of pilot cable so that it may be placed at the operating station.

The brazing transformer is air cooled by induced draft. Air is drawn into the brazer through openings under the top cover, is pulled through the transformer and expelled through screened openings in the bottom of the brazer case.

•

4,500-Deg. Fluorescent White Announced

NEW fluorescent lamps, designated as 4,500-deg. white lamps, in 40-watt T12 and 100-watt T17 sizes have been announced by

Hubbard
Insulator Bolts

SINGLE AND DOUBLE UPSET TYPES
HOT GALVANIZED

*SINGLE UPSET TYPE

Stock No.	DIMENSIONS—INCHES A	B	Thread Dia.	For Use With Insulator No. (Not Included)	Approx. Shipping Wt. Lbs., 100 Pcs.
8740	11¾	7	⅜	455 or 355	170
8741	12¾	8	⅜	455 or 355	180
8741½	13¾	9	⅜	455 or 355	189
8742	14¾	10	⅜	455 or 355	197

*DOUBLE UPSET TYPE

Stock No.	DIMENSIONS—INCHES A	B	C	Thread Dia.	For Use With Insulator No. (Not Included)	Approx. Shipping Wt. Lbs., 100 Pcs.
8824	13	7	3½	⅜	455 or 355	179
8826	14	8	4½	⅜	455 or 355	188
8828	15	9	5½	⅜	455 or 355	196
8830	16	10	5½	⅜	455 or 355	204

*All sizes listed are Rural Standards

Single Upset Type

Double Upset Type

Other types and sizes of Single and Double Upset Bolts can be supplied on special order but are not carried in stock.

HUBBARD and COMPANY
PITTSBURGH • CHICAGO • OAKLAND, CAL.

Sylvania Electric Products, Inc., Salem, Mass.

A result of more than two years of research and testing of new phosphorescent coatings and lighting performance, these lamps are offered for many applications where lighting can be improved by using a colored light source "warmer" than standard 6,500-deg. daylight lamps and "cooler" than the standard 3,500-deg. white types.

Initial ratings reported for the new lamps are 50 lumens per watt for the 40-watt size and 40 lumens per watt for the 100-watt size. They are interchangeable with fluorescent lamps of the same wattage ratings now used in existing fixtures.

•

D.D.T. and Lamp Bulb Kill Annoying Bugs

A NEW version of the moth to the flame story is provided by D.D.T. Lite, Inc., of 3757 Wilshire Blvd., Los Angeles, Calif. This patented device for killing insects attracted to light at night consists of the usual electric light bulb and a wire screen coated with D.D.T. crystals. Moths, mos-

quitoes, night-flying beetles and other annoying bugs drawn to the light brush themselves off with D.D.T. and cease to be a problem in the home or on the porch. The company is also going into production of D.D.T. snap-on screens which will fit bulbs already installed.

•

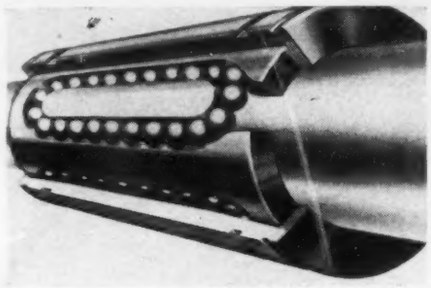
Safety Cap Protects Convenience Outlet Openings

A PLASTIC, one-piece construction, beveled-rim Safety Cap has been designed by Amerline, 1753 North Honore St., Chicago 22, Ill., to protect openings on convenience outlets. It is stated to fit snugly into standard 115- or 220-volt outlet openings and to prevent lint, dust, moisture, etc., from entering and to prevent children from inserting pins, wires, etc., in the openings.

Anti-Friction Bearing Developed for Linear Motion

ANTI-FRICTION bearings for linear motion on circular shafts have been developed by Thomson Industries, Inc., Long Island City, N. Y. The units, called Ball Bushings, are available for use on shafts varying in size from $\frac{1}{4}$ to 4 in. in diameter.

Sizes from $\frac{1}{4}$ to 1 in. vary in $\frac{1}{8}$-in. steps; from 1 to 3 in. in $\frac{1}{4}$-in. steps; and from 3



to 4 in. in $\frac{1}{2}$-in. steps. Standardization of the same type of bearing for square shafts is not yet complete but is expected later this year.

•

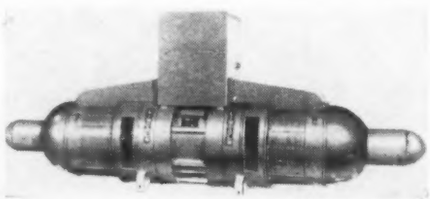
Two 600-Amp. Generators On Single Welding Unit

A NEW welder of 1,200-amp. capacity comprising two 600-amp. generators, close-coupled to an a.c. induction motor and equipped with complete motor control, is announced by The Lincoln Electric Co., Cleveland, Ohio, for use with the company's recently introduced process of automatic metallic shielded arc welding. The unit is of arc welded steel, drip-proof construction and is completely wired, ready for connection to the a.c. power source and to the "Lincolnweld" head of the stationary, self-propelled carriage or tractor type.

Generators are of the variable voltage type with completely laminated magnetic circuits (frame and pole pieces) and equipped with interpoles. Armatures are insulated with glass and mica insulation to permit sustained operation at high loads. Interpoles are insulated with asbestos. Series coils are so designed that Class "A" insulation only is needed. Absence of intermediate taps in series coils makes them compact and well ventilated. Arrangement of shunt and differential series fields are the same as in company's "S.A.E." single operator generators.

Motor is of the squirrel-cage induction type arranged for Y-Delta starting. Connection is for 220, 440, or 550 volts, three or two phase, 60 or 50 cycles.

Since both generators are excited from the



same exciter and controlled from the same rheostat and driven from the same motor, problems of parallel operation are not present. Also, because these welders are used only for automatic welding, the control is very simple compared to that for manual welders which must provide a variety of types of arc for hand welding.

The starter is Y-Delta type, having two switches operated from one push button. These switches make connections on the stator winding so that the "Y" connection is used for bringing the machine up to speed with one third of the normal across-the-line inrush current. When the machine approaches full speed, a transfer relay energized from the time delay switch circuit makes connections such that the "Y" start switch opens and the "delta" run switch closes, thus closing connections which give the motor its full power for driving the generators. It takes approximately seven seconds for the motor to reach full speed and the delta switch to close. The push button circuit is arranged so that the green (start) button must be held in until after the "delta" run switch has closed, which occurs when welder reaches full speed.

•

Snap Switch Has Short Movement; Light Pressure

THE NEW class 9007 Type A Snap Switch is approximately $2\frac{1}{2}$ x 1 x $\frac{7}{8}$ in. in size, has a rating of 550 volts, and is described as a self-

contained mechanism for making or breaking a circuit, in small space, with short movement and light pressure. It is being announced by the industrial controller division, Square D Co., 6060 Rivard St., Detroit 11, Mich. and is reported to have wide industrial applications.

•

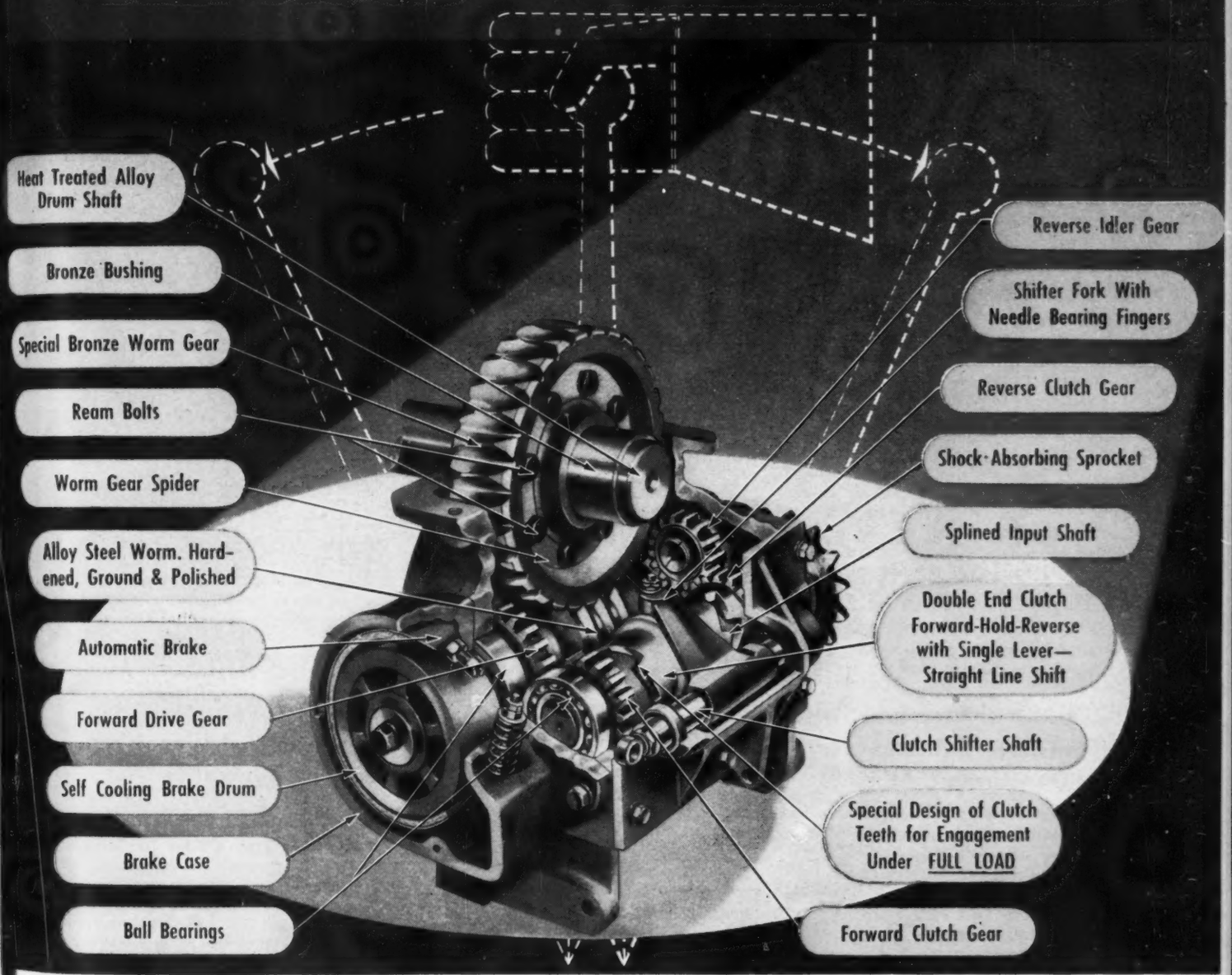
Electronic Control Raises Boiler Efficiency

AN ELECTRONIC mill-feed control, known as Gai-Trol, which is reported to improve the efficiency, output, and performance of grinding mills is being announced by Gai-Tronics Corp., 1417 K St., N.W., Washington, D. C. Its use in power plants utilizing pulverized coal results in an increased boiler efficiency, the company reports.

The equipment consists essentially of a load detector external to the mill and connected directly to the electronic equipment, which is contained in a 66-in. high, floor-mounted, self-supporting steel cabinet. A circuit from the electronic equipment in this cabinet supplies a variable-speed, direct-current, feeder-drive motor.

The circuit between the load detector and

Advanced Engineering Features of the GAR WOOD RAPID REVERSE WINCH



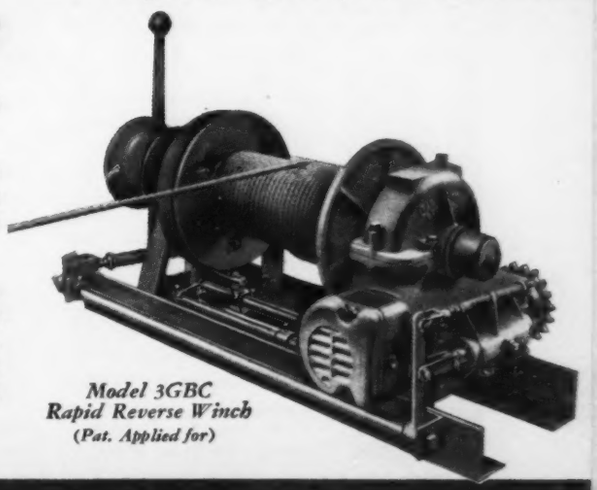
Exposed view of the Rapid Reversing Mechanism.

Wherever Industry Needs A LIFT

The inbuilt rapid reverse mechanism, designed by Gar Wood engineers, is the greatest development in truck winches in the last 20 years.

This exclusive reversing mechanism provides complete and instant winch action—hoisting, holding, or paying out is done under full load without declutching the engine or power take-off. The single lever control may be mounted in the cab, on the winch or at the rear.

Three point flexible mounting prevents distorted shafts or cramped drums. Oversize shaft is carried on spherical, self-aligning bearing . . . Worm shaft is ground to exact size and polished . . . Gear teeth are hardened and shaved. The drive is by heavy duty power take-offs, either single or two forward speeds. Gar Wood traditional high quality is maintained throughout, and long life and trouble-free operation are assured.



Model 3GBC
Rapid Reverse Winch
(Pat. Applied for)

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WINCH AND CRANE DIVISION DETROIT 11, MICHIGAN

WORLD'S LARGEST MANUFACTURERS OF TRUCK AND TRAILER EQUIPMENT

OTHER PRODUCTS: Hoists • Bodies • Tanks • Road Machinery • Heating Equipment • Boats

the feeder is direct and entirely electronic. No relays, moving parts or mechanical speed change equipment is involved. The speed of the feed motor is controlled precisely and continuously throughout a stepless range and without lag, cycling, intermittent action or over and under "hunting," the company reports.

•

Electric Swing Stage Simplifies Painting

AN ELECTRIC swing stage, designed to ease the task of hand-operated block and tackle stages for building painters has been introduced by the Electric Swing Stage Co., Spokane, Wash.

Powered by a ¾-hp. motor and ranging in length from 16 to 24 ft., the new stage can move two painters and their equipment up or down the side of a building 18 ft. per minute. Weighing 300 lb. fully equipped, it has 500 ft. of cable and 100 ft. of electric cord.

Each stage is equipped with a small two-wheel dolly for moving it about on the ground. The two steel supporting cables have a breaking strain of 11,600 lb. and have been tested with five men aboard.

The cables are wound on two separate drums which provide for horizontal adjustment of the stage when painters are working on an uneven roof. Manufacturers of the stage claim approximately twice as much work can be accomplished with their product as with block and tackle stage.

•

Thermalarm Indicates Hot Transformer

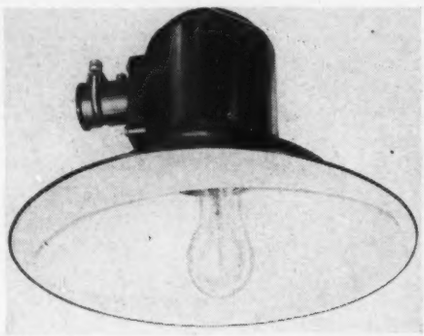
THE FACT that a transformer is now or has been operating above a predetermined limit is indicated by a new device, called Thermalarm, now being manufactured by the Eastern Specialty Co., 3617 North Eight St., Philadelphia 40, Pa.

Housed in a Melmac plastic case, 3⅜ in. long by 1⅞ in. wide by 1⅞ in deep, the unit has a die-cast aluminum base, which acts as the heat conductor, projecting from the back. The case completely encloses a thermal responsive element which controls a latch and releases a flag when the safe operating temperature is exceeded. The flag, which is spring actuated and which is normally in a downward position, flies up and presents a brilliant red surface that is large enough to be visible from the ground level.

The unit can be preset to actuate the latch at any point between 100 and 200 deg. F. The device, which weighs 3 ozs., is reported as simple to apply since it is held to the transformer case by an adhesive.

Oval Street Light Unit Has 85-Deg. Cut-Off

AN OPEN-TYPE street lighting unit with parabolic oval contours for small street lamps



has been announced by the Westinghouse Electric Corp., Pittsburgh 30, Pa.

Designed so that the bottom edge of the lamp filament is approximately ¾ in. above the lower edge of the reflector, thus giving a cut-off of 85 deg. from the vertical, the luminaire uses either 1,000- or 2,500-lumen, 5⅜-in. light center lamps.

The unit is supplied for mounting on 4¼-in. and 3⅛-in. standard heel adapters, or on screw heel adapters; it replaces the radial wave reflectors on any type of hood.

•

Motor-Starting Relay Actuated By Back E.M.F.

MANY DIFFICULTIES encountered with centrifugal throwout mechanisms are eliminated by a new positive-action motor-starting relay, reports Potter & Brumfield Mfg. Co., 540

West Washington Blvd., Chicago 6, Ill., in announcing relay Model MS2A.

It is voltage actuated and operates on the back e.m.f. of the starting winding. When the motor has attained speed, this relay disconnects the starting coil from the line. Overload, with its attendant heavy current flow, does not prevent it from operating once proper motor speed has been reached the company reports. Back e.m.f., induced in the starting coil by armature rotation, is stated to assure a permanent disconnect as long as the motor maintains its rated speed.

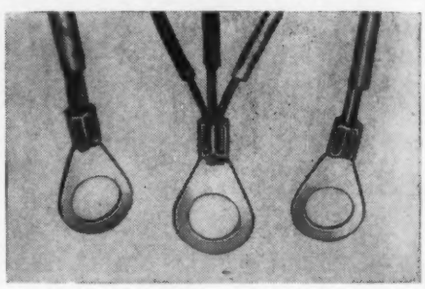
The report states it operates over a wide range of line voltage variations and is reliable on normally low lines. The unit can be mounted on the motor housing or located at any distance, thus permitting operation of the motor in a combustible atmosphere.

•

New Terminal Lug Crimp Centers Solid Conductor

INSTALLATION TOOLS and terminal lugs for attaching solderless lugs to solid wire or to a combination of solid and stranded wire is being announced by Aircraft-Marine Products Inc., 1591 I North 4th St., Harrisburg, Pa.

The mechanical connection is made by a crimping operation and is reported to with-



stand vibration and torsional twist. Terminals are all copper, hot electro-tinned. They have a short barrel and, when crimped, are reported not to have caused a spreading of the barrel.

The crimp shape which makes use of two indentations is said definitely to locate the solid conductor in the central position. Terminals and installations tools are available for wire sizes No. 22 to No. 10 inclusive.

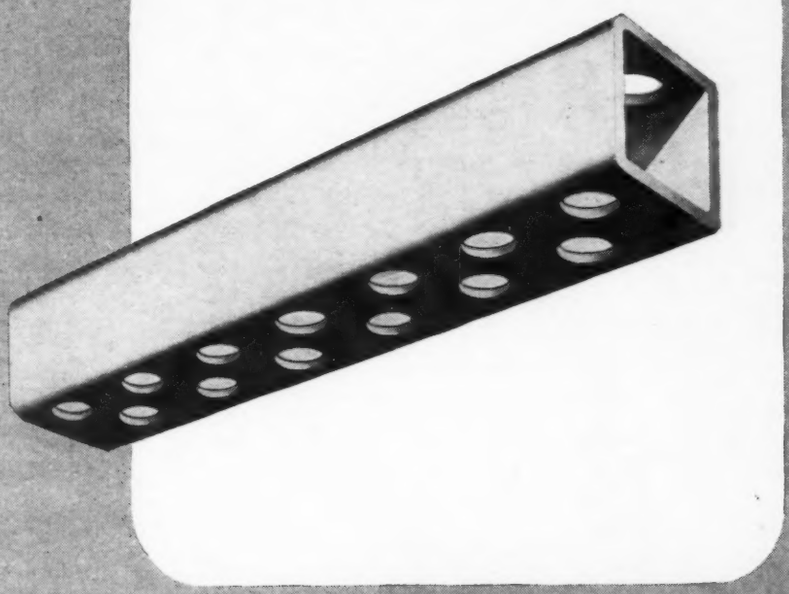
•

CO_2 Portable Extinguisher Made by General Detroit

CARBON DIOXIDE portable fire extinguishers (called CD-Sno-Fog), in a complete range of sizes from 2 to 100 lb. are being announced by General Detroit Corp., 2270 East Jefferson Ave., Detroit 7, Mich., and General Pacific Corp., 1800 South Hooper St., Los Angeles, Calif. The units are recommended for fighting fires in electrical equipment, oil, grease, and flammable fluids.

The report states that the effectiveness of the units is brought about by the heavier-than-air gas which penetrates into remote corners and replaces the oxygen which is necessary for combustion. The cylinder of the extinguisher is made of steel and has brass fittings. The units are made in 2, 4, 7½, 10, 15, 20, 50, 75, and 100-lb. sizes. The discharge horn is of shock-resistant plastic. Carbon dioxide is usable in hot or sub-zero temperature.

For *MAXIMUM* mechanical strength



CHASE "SQUARE COPPER" bus conductor

YOU get maximum mechanical strength in both directions when you install this Chase Copper Bus Conductor. The reason: it is one-piece *square* bus tube, which was first developed commercially by Chase Brass & Copper Co.

To this basic improvement in bus design, Chase engineers have added still further refinements: ventilating holes in both top and bottom faces, to increase current-carrying capacity . . . rigid, one-piece construction, to save installation time and labor.

Taken together with copper's high electrical conductivity, these features offer everything you could want in a modern bus conductor. Before you decide on any new AC bus installations, send for the Chase Electrical Handbook. For a complimentary copy, simply address Dept. EW-66A.

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TECHNICAL LITERATURE

Nomographs—The second in the series of GTR Nomographs for engineers has been issued by the Federal Telephone and Radio Corporation of Newark, N. J.

The set, 16 in number, makes a total of 40, 24 being issued in the first group, in a projected series which when completed will include more than 100 graphic aids for the designer of radio, UHF and television equipment. Many of the nomographs in the current series supplement those presented in the last one. For instance, while the last series contained many design formulas for high frequency transmission lines, this set emphasizes the other method of transmitting high frequency energy—the wave guide. Ten of the nomographs are on this subject and they include virtually every wave guide formula that the engineer would normally utilize. Between the two groups almost any transmission line problem can be solved with a straight edge.

Other nomographs supplementing those previously presented are the Shunt Peaking Method of Range Extension in Wide Band Amplifiers and the Dissipation of Power in Water Cooled Devices charts. Some completely new subjects have been covered in this series, such as two nomographs on Attenuators, one on Minimum Loss Pads and one on Paint Requirements. Copies of the nomographs can be obtained by writing to Federal Telephone and Radio Corporation, Newark, N. J.

Welding Handbook—This handbook is a complete and authoritative manual on the subject of welding inspection. It covers the requirements and duties of a welding inspector, methods of testing welds, and contains a comprehensive description of weld inspection by visual, magnetic-particle and radiographic methods. One section of the handbook discusses the principal type of weld defects and indicates how they may be detected and corrected. The book is written in simple language and is intended to serve as a reliable source of information on any welding inspection problem. Copies may be obtained from the American Welding Society, 33 West 39th St., New York 18, N. Y., at $1.50 per copy.

Research—Technical facilities and research activities of the Armour Research Foundation of the Illinois Institute of Technology during 1944 and 1945 are described in the Foundation's 9th Annual Report of Industrial Research Progress, a 20-page pamphlet recently published. Chronicled in the report are activities in electrical engineering research as well as in other major fields of chemistry, metallurgy, mechanical engineering, physics, etc. The Foundation is a non-profit institution established in 1936 to render research and experimental service to industry. Copies of the report may be obtained from the Armour Research Foundation, Chicago 16, Illinois.

Transformers—NEMA Standards for Specialty Transformers, bulletin No. 45-98, covering general-purpose specialty transformers, control transformers, high-reactance control transformers, signalling, luminous-tube, ignition and door bell transformers, as well as lead markings, terminal connections and definitions, is now available. Copies may be obtained from National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y., for $2.00 each.

Wiring—Handbook of Residential Wiring devoted entirely to single family dwellings is now available from the National Adequate Wiring Bureau, 155 East 44th St., New York 17, N. Y. It was sponsored by seven of the national associations in the industry and bears the endorsement of A.I.E.E. and I.E.S. The handbook contains a description of the general requirements of each room from cellar to attic. The Bureau has adopted the handbook as the basis for development of certification standards. Single copies are available for 25 cents and discounts are allowed on orders for quantities greater than ten.

BOB, LEN AND BERNIE BUSCH, 4-H'ers all, try out their Better Method for building concrete greenhouse benches at Golden Valley, Minnesota.

4-H'ER CATHERINE DUEVEL is busily developing a Better Method for making a party dress, at her home near Minneapolis. The entire Duevel Family is active in 4-H Club work.

Why not join the Big Parade to Better Methods . . . NOW?

Do as scores of progressive utilities are now doing — by tying-in your rural activities with this national program that is *right now* operating in your territory.

There is nothing for you to *develop* or *originate* to identify your organization with the 4-H Club Better Methods Electric Contest.

FREE... everything you need for promoting your own Better Methods Electric Program

GUIDE BOOK — Explains Better Methods and how to apply them in simple, understandable language. Packed with factual information on farm and home jobs and chores.

REPORT FOLDER — Contains convenient blank forms for 4-H'ers to develop and report their Better Methods Electric Projects.

LEAFLET — A complete explanation of each step of the Contest, also rules and regulations . . . for widespread distribution to 4-H'ers.

POSTER — For display in your showroom windows in your farm territory — to establish them as information stations on the Electric Contest.

FARM BULLETINS — Twelve Bulletins on the many and varied uses of electricity on the farm and in the farm home.

IDEAS — Many useful suggestions to help you conduct your locally-sponsored Better Methods Electric Program.

Send for PORTFOLIO!

To start the Better Methods Electric Program working for you, send for the portfolio: "A Rural Community Service Program." In it you will find samples of the free material described above, and other helpful information. *Contact your nearest Westinghouse Office — or mail coupon, now!*

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NEWS ABOUT PEOPLE

Illinois Northern Utilities Elects Fluehr President

At a recent meeting of the board of directors of the Illinois Northern Utilities Co., Dixon, Ill., George B. Fluehr was elected president of the company to succeed George R. Jones, who is retiring from the position following 14 years of service. Mr. Jones will continue as a member of the board. Richard E. Wahler, district superintendent at Freeport, was named vice-president. Also announced were the appointments of L. G. Cannon and Arnold Schultz as assistants to the president.

Mr. Fluehr's election to head the utility company climaxes a career of 42 years in the utility business, during the last 16 of which he has been vice-president of Illinois Northern Utilities Co. He

G. B. FLUEHR

started with the companies that later consolidated to form the I.N.U., entering the employ of the Amboy (Ill.) Lighting & Power Co. in 1904. In 1909 the Oregon (Ill.) Power Co. purchased the property and retained Mr. Fluehr as manager of the Amboy division. Shortly after the I.N.U. purchased the Oregon system in 1912, he was made manager at Morrison, subsequently being transferred to Sterling, where as district superintendent he was given responsibility for the company's operations in Sterling, Morrison, Fulton, Prophetstown and several smaller communities. In 1919 he was placed in charge of the company's largest district as district superintendent at Freeport. Mr. Fluehr was made vice-president in 1930, and four years later, upon the death of E. D. Alexander, he was placed in charge of all company operations.

R. E. WAHLER

Mr. Wahler became identified with the company in 1917 and has served successively as meter reader and tester, superintendent of the meter department, storekeeper, office manager, assistant to district superintendent and district superintendent, the position he held at Freeport, before his recent election to the vice-presidency.

Both Mr. Cannon and Mr. Schultz are veterans in the company service. Mr. Schultz has been electric operating superintendent and Mr. Cannon has been assistant to the vice-president and general contract agent.

•

► GEORGE W. GILLIAM has been elected a vice-president of the Central Power & Light Co., Corpus Christi, Tex. Mr. Gilliam has been identified with Central Power & Light for the past 22 years. He became a member of the executive department last November after serving as a naval officer for several years during the war. Before joining the Armed Forces he had been a division manager of the company's Gulf Coast and Corpus Christi districts.

► E. C. STARR, electrical engineering professor at Oregon State College, has been named by the National Academy of Science to be one of 20 civilian scientists for observation of the July atomic bomb tests at Bikini Atoll.

Morgan Made Assistant Managing Director, E.E.I.

A. B. Morgan has been appointed assistant managing director of the Edison Electric Institute, Col. H. S. Bennion, vice-president and managing director of the Institute, has announced.

Mr. Morgan has been the rate and power consultant for E.E.I., heading both the rate and general service departments. In his new position, he will assist Col. Bennion in the supervision of the Institute's operations, and will also continue his present responsibilities.

A graduate of M.I.T., Mr. Morgan joined the National Electric Light Association, predecessor of E.E.I., in 1927 as an assistant engineer. He specialized in codes and standards activities, representing the electric light and power group on committees of the American Standards Association. He was promoted to engineer in 1933 and later became rate and power consultant. He has

A. B. MORGAN

acted as staff representative of the industrial power, rate research and post-war planning committees.

Mr. Morgan is a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers. He has served for the past fifteen years on the A.S.M.E. oil engine power cost committee.

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► R. I. SEYMOUR, advertising and publicity director of the Kansas City Power & Light Co. for the past nine years, has

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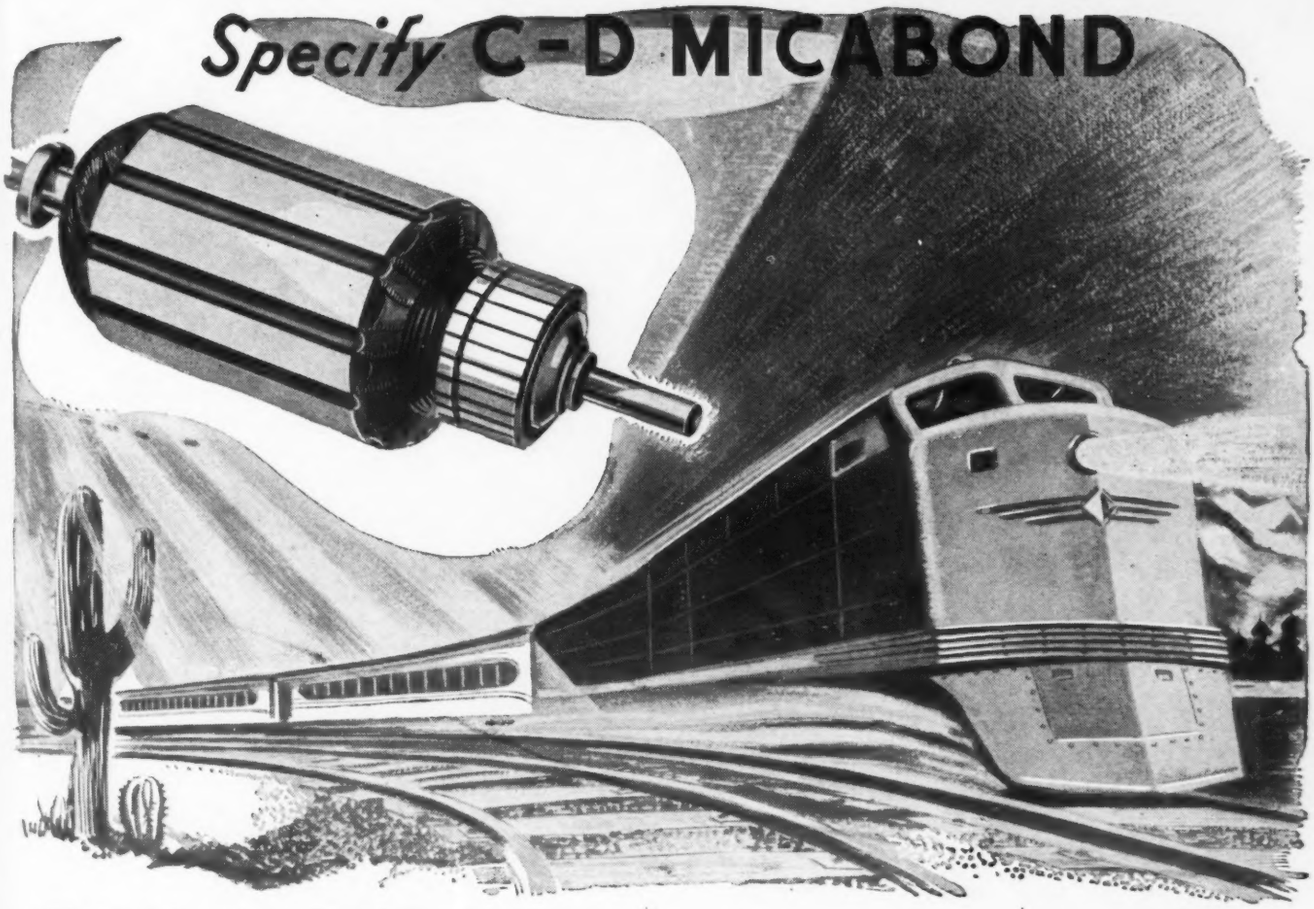

The power that drives a Diesel Locomotive is Electricity! Electricity generated by huge Diesel Driven Generators . . . generators that depend on C-D MICABOND insulation to stand the high heat and vibration of continuous operation. The small armature illustrated separately is used in your automobile generator . . . it too must give long dependable service . . . furthermore it must also be economical to produce so it is built on a fast moving assembly line. Accuracy in dimensions is essential in both these uses of C-D MICABOND insulating rings and segments . . . first to insure unfailing service; secondly to facilitate fast economical assembly.

KW-45

FOR dielectric properties and heat resistance that will provide the stamina needed to drive giant locomotives . . . for accuracy in dimensions that expedite production on fast moving assembly lines . . . specify C-D MICABOND rings and segments.

C-D MICABOND is Mica in usable forms. MICA splittings bonded together in sheets and tubes from which segments, rings and other shapes are readily and accurately fabricated. Into every shipment of C-D MICABOND goes a half century of C-D "know-how" . . . your assurance that C-D MICABOND is engineered to do the job for which it is specified.

C-D PRODUCTS

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DILECTO—A Laminated Phenolic.
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HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

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VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

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Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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resigned to become vice-president in charge of sales for the Electra Manufacturing Co., manufacturers of automotive electrical replacement parts. He will assume his new duties on July 1. Before joining the Kansas City utility, Mr. Seymour spent eleven years in sales and promotion work for the General Electric Co. He is a past-president of the Public Utilities Advertising Association.

•

Kuhlman Electric Appoints Ellerman Sales Manager

Announcement has been made of the appointment of A. H. Ellerman to the position of sales manager of the Kuhlman Electric Co., Bay City, Mich. Mr. Ellerman previously served as assistant sales manager of the company.

Before joining the Kuhlman organization two years ago, Mr. Ellerman was a

A. H. Ellerman

member of the power equipment section of the Office of War Utilities in Washington, D. C. He has been a well known figure in the transformer field for 26 years, having filled important sales positions with a number of manufacturers including International Western Electric Co., Ltd., in Buenos Aires, Argentina, which is now owned and operated by the International Standard Electric Corp., New York; Moloney Electric Co. and Wagner Electric Corp., both of St. Louis, Mo. He served the last named as assistant sales manager of the transformer division.

•

▶ Warren K. Lewellen has been appointed power sales engineer for the Lowell (Mass.) Electric Light Corp., following an earlier connection with the New England Power System, superseded by work in the military construction field at Fort Devens, Mass., and other assignments.

Elias J. Strong Resigns from Intermountain Group

Elias J. Strong, manager of the Intermountain Electrical Association, Salt Lake City, since last October, resigned on June 1 to become secretary-manager of the Utah Automobile Dealers' Association.

For the three years preceding his appointment as full-time manager of the Association, Mr. Strong had been secretary to Gov. Herbert B. Maw of Utah. Prior to that he was manager of the Electrical League of Utah, predecessor of the Intermountain Electrical Association. Earlier he had been identified with the Utah Power & Light Co.

•

▶ James V. Toner, president of the Boston Edison Co., has been elected a member of the board of directors of Raytheon Manufacturing Co.

▶ Randall J. Miller, trade relations supervisor of the Electrical League of Cleveland, has been named assistant residential sales manager of the Cleveland Electric Illuminating Co. Mr. Miller has a long record of sales experience. He had spent 13 years in the retail selling field prior to joining the League, where he has been employed for ten years.

▶ John M. Weir, superintendent of the Cowlitz County Public Utility District, Longview, Wash., has resigned, effective July 15, to become manager of the public utilities in Ketchikan, Alaska. Mr. Weir was formerly employed in utility operations at Fairbanks, Alaska. C. T. Hurd of Kalama, Wash., has been appointed manager of the Cowlitz County P.U.D., succeeding Harry G. Kelsey, who will leave Longview next month to take a position elsewhere.

▶ Loftus H. Reid has been appointed to the Toronto Hydro Commission to replace Kenneth A. Christie, whose term ended on May 31. Mr. Reid had served on the commission some years ago.

▶ Henry M. Chance, II, has been appointed to the position of assistant to the president of United Engineers & Constructors Inc. Mr. Chance has been identified with United Engineers & Constructors since 1936, first on engineering and operation of a series of installations of the Chance sand flotation process for cleaning bituminous coal at mines, and then he was transferred to the chemical department. In 1942 he was appointed assistant construction manager on many projects, including Deepwater generating station at Deepwater, N. J., for Deepwater Light & Power Co. and four floating power plants for DPC. His present construction activities include the Southwark generating station for Philadelphia Electric Co. and a chemical plant at Waterford, N. Y., for General Electric.

•

Graham Appointed Manager of Technical Relations

Appointment of Virgil M. Graham as manager of technical relations for Sylvania Electric Products Inc. has been

V. M. Graham

announced. Mr. Graham was formerly manager of the Sylvania industrial apparatus plant at Williamsport, Pa.

Mr. Graham's new duties will include activities making for closer coordination between various engineering groups in addition to maintaining close liaison with advertising and public relations activities. He will also direct the activities of the company with professional and technical associations. He joined Sylvania eleven years ago.

Mr. Graham is active in the Radio Manufacturers Association, is a fellow of the Institute of Radio Engineers and a member of other technical associations.

•

▶ Bertram J. Cross has been named to take over management of the development and research department of Combustion Engineering Co., succeeding the late Henry Kreisinger with whom he had been closely associated for more than 25 years. Mr. Cross joined Combustion Engineering Co. in 1929 and was identified with the early applications of pulverized coal to power boilers, notably those at Oneida Street and Lakeside Stations, Milwaukee. With the exception of two and one-half years spent away from the company in the early thirties, he has given his entire time to research and development, involving field work in

TIME	CURRENT AMPS.	T_1 LOWER JAW	T_2 TOP JAW	T_3 4/07 Str WIRE	T_4 GRIP UNDER NEOPRENE	T_5 4/0 FLEXIBLE WIRE RUBBER INSUL.
6:10	350	START	—	—	—	—
6:30	350	122	110	125	95	118
7:00	340	155	140	150	135	150
7:20	340	160	145	155	140	155
8:05	356	175	155	162	150	162
8:45	356	180	160	165	155	165

(All temperatures in degrees Fahrenheit)

Typical heat run shows that current carrying capacity of the Fargo Jumper is more than adequate for 4/0 Strand. Temperature rise is less than 16% at point of contact.

WIRE SIZE	INCH POUNDS TURNING TORQUE TO MAKE UP	TOTAL JAW PRESSURE (Pounds)
4/0 Strand	40	120
2 Solid	20	70
6 Solid	10	40

Make-up torque and pressures developed at jaws of Jumper. Pull out values of 180 pounds were obtained with 4/0 7 Strand bare wire.

Test data on temporary jumper indicates advantages for use on semi-permanent installations.

The Fargo TJ1 Hot Line Jumper is the result of careful research and development in the laboratory and field. Test data shown here and reported in the June 8th issue of Electrical World indicates not only a wide margin of safety for emergency use but practical advantages for use on semi-permanent installations as well.

For instance, there is no need to retighten the jumper once it is installed. The spring maintains uniform pressure regardless of vibration. The overall resistance of the jumper from the end of the flexible wire to the conductor (including the contact resistance) is 150 microhms. The average contact resistance is 45 microhms. The resistances are so low that IR drops when the jumper is in use are negligible.

Materials selected for specific application.

For example, the plunger, cam riser insert and tap wire bushing are made of silicon bronze, the guide pin of stainless steel and the headpiece and handle are cast from an age-hardening aluminum alloy. The molded neoprene covering which is permanently bonded to the metal was oven heated to 340 degrees F. without destruction. No faults occurred with the 165 degrees F. reached on the electrical heat run.

Special tap connection easily accessible.

Joint resistance is eliminated in a corrosion-proof tap wire connection which takes up to 4/0 Strand. A tinned joint is made between a male threaded bushing and the tap cable. The assembly is then screwed in the handle of the Jumper. Locking set screws on the cable and bushing prevent mechanical disassembly or disconnection by fault currents melting the tin. With this readily accessible unit, repairs and replacements are easy.

For further information and prices write the Fargo Mfg. Company, Poughkeepsie, New York, or get in touch with your Line Material representative.

Full Fargo line of Vise-type Connectors, Automatic Line Splices, Hot Line Taps and Sticks, Multiple Taps, Dead Ends, Compression Cone Connectors, Sleeves, Ground Clamps, and other Electrical Specialties are distributed by

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testing, temperature measurements, boiler water studies and fuel-burning problems. Before affiliating himself with Combustion Engineering, he was on the staff of the U. S. Bureau of Mines where he engaged in fuels research. Mr. Cross is a member of several committees of the American Society of Mechanical Engineers, including boiler feedwater studies and boiler test code and fuels and has been the author of numerous papers before that society and other engineering bodies.

▶ WILLIAM G. HALL, who has been in charge of renewal parts and repairs for the Reliance Electric & Engineering Co., during the war years, has been made manager of a combined renewel parts and service division. In his enlarged responsibilities, Mr. Hall succeeds ARTHUR W. RAY, who retires after completing 40 years with Reliance, the past 21 of them as service manager.

▶ WINFIELD WAGENER has been appointed to the sales engineering staff of Eitel-McCullough, Inc., San Bruno, Calif.

OBITUARY

▶ JOHN B. FISKEN, retired consulting engineer of the Washington Water Power Co., Spokane, died recently in that city at the age of 84. Mr. Fisken retired in 1942. A native of Scotland, he came to the United States in 1886 and joined the Spokane Electric Light & Power Co. in the following year. His duties ranged from lineman, plant operator, general electrician and utility man to manager. He remained with the organization when it was replaced by the Edison Electric Illuminating Co. and later when that company was absorbed by Washington Water Power Co. He served as superintendent of light and power, in 1918 was appointed chief engineer, and subsequently consulting engineer. Mr. Fisken was a fellow of the American Institute of Electrical Engineers and a past-president of the Northwest Electric Light & Power Association, in the latter having been active in safety work.

▶ JOHN M. HARKINS, division planning engineer for the 60-cycle divisions of the Southern Ontario System, Hydro-Electric Power Commission of Ontario, died on May 21. Mr. Harkins was born in Toronto, Ont., and received his engineering education at the University of Toronto. After two years with Dunlop Tire & Rubber Co., he joined the staff of the Hydro-Electric Power Commission as draftsman-designer in the station design section in 1921, becoming general design engineer on the Eastern Ontario System in 1925. He had held the position he occupied at the time of his death since 1939. Mr. Harkins was the au-

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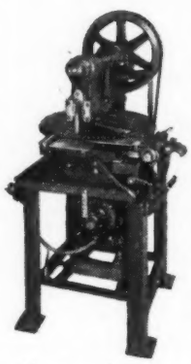

Above — Power Press. This model provides combination of ¼ and ⅜" letters

THERE are a thousand and one uses for these indispensable machines: for marking patterns, systematizing pattern departments and storerooms . . . for gas and electric meters . . . for pole tags . . . for marking wires, cables . . . for following parts through processes of manufacture.

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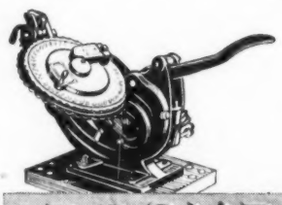

The Hand Label Embosser (above), Hand operated Model II (left).

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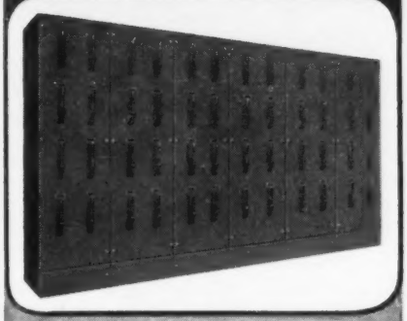

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SWITCHBOARDS · PANEL BOARDS
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thor of an article "Buffer Reactor Limits Arc Furnace Flicker," published in October 13, 1945, issue of ELECTRICAL WORLD.

▶ IVAR LUNDGAARD, commercial manager of the Rochester Gas & Electric Corp., Rochester, N. Y., died on June 7 at his home in that city in his sixty-fifth year. Mr. Lundgaard joined the Rochester utility in 1909 and in 1915 when the company's industrial sales department was formed, he was made its manager.

▶ EDGAR L. FEININGER of Schenectady, N. Y., assistant general manager of the chemical department of the General Electric Co., died suddenly on June 9 while attending a company outing at Lake George. He was 56 years old. A native of Troy, N. Y., and a graduate of Rensselaer Polytechnic Institute, Mr. Feininger immediately went to work for the General Electric Co. as a chemist in the research laboratory. In 1920 he joined the insulating materials divisions and six years later became supervisor of the varnish and mica products department. In 1931 he was named managing engineer of the resin and insulation materials division and last year was named assistant general manager of the chemical department.

▶ FREDERICK MEYER, who served many years ago as superintendent of the Monroe (La.) city power and light plant, died recently at the age of 80. Mr. Meyer had retired from business in 1929. He served for 25 years as superintendent of the power plant before leaving to organize the Monroe Electrical Supply Co., which he operated until his retirement.

▶ HARRY A. YOUNG, advertising manager for the California Oregon Power Co., Medford, Ore., died on June 6 of a heart attack in that city. Mr. Young was 55 years of age.

▶ LOUIS O. D'OLIVE, power sales representative with the Mobile office of the Alabama Power Co., died on June 8 at his residence in Mobile following a brief illness.

▶ ARTHUR L. HOLMES, 54, district manager for the Boston Woven Hose & Rubber Co., died at Natick, Mass., on June 4. He was a native of Braintree, Mass.

▶ HARRY F. SHEARER, engineer with the War Assets Corporation, Canada, died suddenly on May 24 at his home in Toronto after a heart attack. A graduate of the University of Toronto, Mr. Shearer had served as general manager of the Welland (Ont.) Hydro-Electric Commission for 16 years and of Smith's Falls (Ont.) hydro for five years.

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Transformers—
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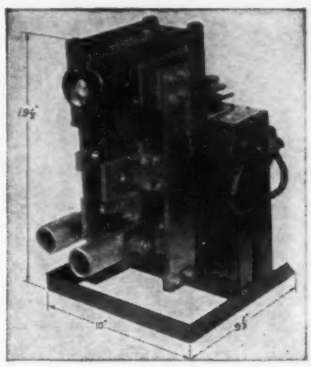
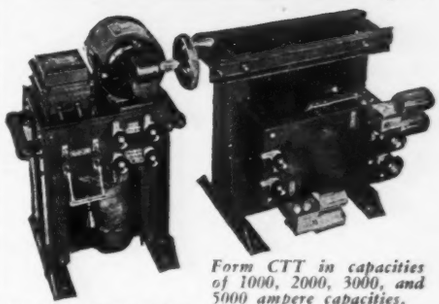


Type M, 300 and 800 ampere capacity

These Loads are designed to provide a source of heavy current with minimum weight. See Cat. 1 Sec. 1 for full details.

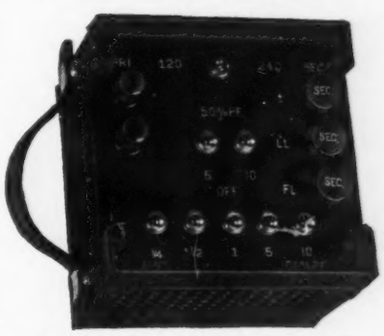
STATES TESTING EQUIPMENT



Portable Outfit—Compact—very Convenient.

Form CTT in capacities of 1000, 2000, 3000, and 5000 ampere capacities.

One unit includes the Loading Transformer and the second unit consists of Auto-wound Transformer, control switches, and Regulator.



Type 1 Load, Cat. No. 11569, capacity 15 ampere, 120-140 volts.

Here is a positive way to test 50% power factor of 5, 10, 15 ampere watthour meters.

Tear off and mail today to
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3 New Park Ave., Hartford, Conn.

Please send me information on Loading Transformers. I am interested in testing.....

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MANUFACTURERS & MARKETS

Battery Lab Dedicated by Gould

To increase the scope of battery research and to test the data obtained in production were the basic themes expressed by officials of the National Battery Co. and the Gould Storage Battery Corp. at the recent dedication of the new research laboratory and pilot plant in Depew, N. Y. The laboratory is provided with electrical, physical and chemical testing equipment; the pilot plant is provided with equipment for assembling experimental batteries by production methods.

The 90-by 120-ft. building which houses the lab and pilot plant and the equipment represent an investment of approximately $250,000. It will be staffed by 20 research and production specialists.

Greater portion of the floor space of the laboratory is utilized in the preparation and testing of experimental batteries. In addition to the usual tests for capacity, equipment is provided for automatically measuring battery life. The test specimens can be charged or discharged at any desired rate and consequently various types of life tests can be set up on the automatic timers. Rates up to 100 amp. are available for the charge and discharge cycles. The circuits all carry automatic protection against power failure and overload.

Provision is also made for testing large batteries at charge rates up to 3,000 amp. and discharge rates up to 12,000 amp. These circuits are made up of 4-in. busbars and the discharge circuit contains rheostats which control the discharge rate to within 2 amp.

Other testing equipment provided includes hydraulic testing machine, Rockwell hardness machine, X-rays, spectroscope and several microscopes, one for magnification up to 1,500 diameters. The pilot plant contains automatic grid casting equipment, machine pasting apparatus, and facilities for assembling and forming all types of batteries.

John L. Rupp, vice-president in charge of engineering, is supervisor of all operations in the new building. He is assisted by M. Ward Dickover, assistant chief engineer, and Dr. Eugene Willihnganz, director of research.

•

Merges Electronic Units

Combining of the Sterilamp and Tenderay sections at the Westinghouse Lamp Division into the Sterilamp-Tenderay department under Charles W. Flood, Jr., as manager has been announced by Adolph Frankel, manager of the electronic tube sales department, Bloomfield, N. J. Mr. Flood has been manager of the Sterilamp department for the past four years, supervising the company's activities in the bactericidal ultraviolet field. Louis J. Menges, formerly manager of the Tenderay licensing section, resigned recently to open a Montclair (N. J.) office as an architect and consulting engineer for meat packing houses and allied industries.

•

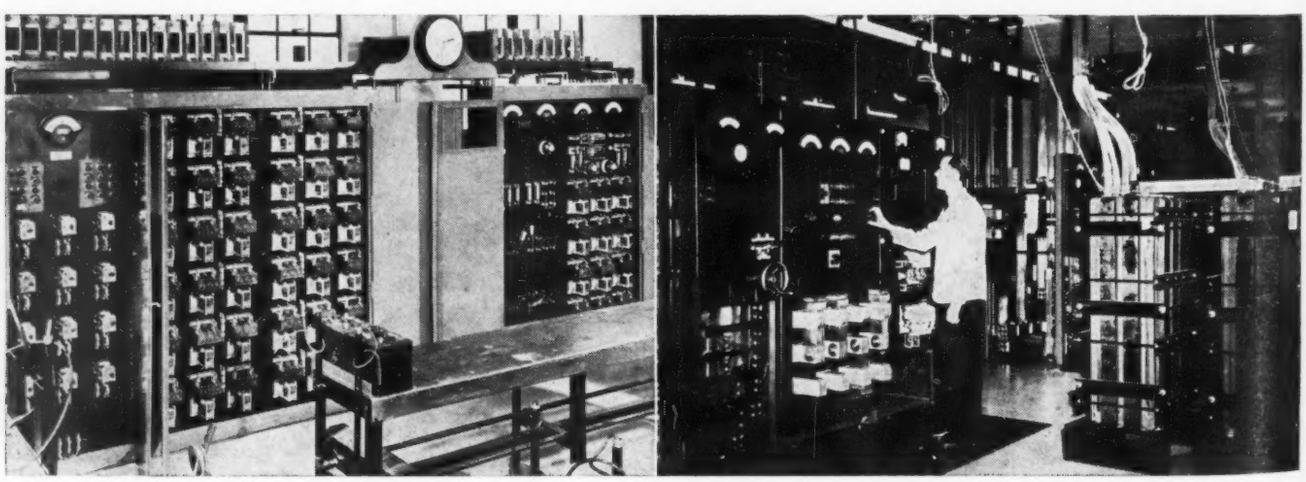
Winners of "How to Use It" Contest Are Announced

The Wiremold Co. of Hartford, Conn., has announced the three big prize winners in their Wiremold Business-Builders "How to Use It" contest, which was open to all contractors and electrical maintenance men from October 1, 1945, to March 31, 1946.

P. M. Pavesich of the Super Electric Construction Co., Chicago, was awarded the first prize of $500. Mr. Pavesich received the award for the Wiremold installation made by his company to provide adequate wiring for fluorescent units in a Chicago railroad office.

The second prize of $250 went to G. A. Chamblin of the California Electrical Construction Co., San Francisco, for his use of Wiremold to wire an eight-story YMCA building.

G. A. Schultz of 2931 Mapleshade Road, Ardmore, Pa., won the third prize of $100 for a complete installation of Wiremold No. 3000 and No. 700 in an



TIME AND CHECKED——Automatic charge and discharge equipment shown in left illustration permits completing tests in 30 per cent less time than with manual equipment. The panel on extreme left contains automatic timers, relays and indicator lights; center panel, automatic switches; and right panel, control apparatus for special tests. Discharging batteries at a rate of 12,000 amp. is possible with the board at the right. Visible behind the panels are resistance units composed of water-cooled brass tubes and at the extreme right the heavy busbars and flexible battery leads

(ADVERTISEMENT)

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

Importance of Protective Film in Extending Condenser Tube Life

The character of the corrosion film which forms on condenser tubes during service is influenced primarily by the nature of the circulating water and the chemical composition of the alloy or metal from which the tubes are made. In general, corrosion films which form on brass are more easily removed than those formed on modified brasses, aluminum bronzes and copper-nickel alloys. The rate of film removal depends upon the temperature, velocity (extent of agitation), and of course the specific properties of the corrosive medium. Hence the nature and distribution of the corrosive film—whether it is continuous and impermeable, or permeable, with physical and chemical properties markedly different from the metal being corroded—has a tremendous influence on the rate of corrosion.

Two Types of Corrosion Films

Let us consider the corrosion films which form as belonging to two different classes—the invisible (frequently protective) and the visible (frequently non-protective). In between these two extremes are corrosion films which have varying degrees of protective values.

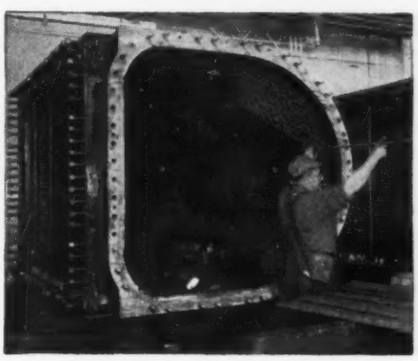
It has been observed repeatedly that the visible films, which are insoluble in the corroding medium, usually have the following characteristics: They are permeable to water (they permit the passage of a fluid through them). They are sufficiently dense to impede the flow of fresh corrosive solution to the metal surface (this may also slow up the rate of corrosion). They may be non-uniform or discontinuous, thus permitting the corrosive solution to come in contact with metal in certain areas and partially screen the metal in others. The corrosion may be increased in certain screened areas (under or around) by the formation of concentration cells. The metal under the thicker portions of partially permeable film usually becomes pitted (anodic area) or attacked by localized corrosion. The exposed metal or those areas covered with thinner films are only slightly corroded (cathodic area). The continuous accumulation of corrosion products of the same type helps to produce deeper pits or to enlarge the area being corroded.

The properties of visible corrosion films aid in the formation of the concentration cell (metal ion and oxygen) types of corrosion. The concentration cell begins to operate when the corroding substance is present in different concentrations at adjacent areas on the metal surface.

Foreign Matter Accelerates Corrosion

The nature and distribution of sand and slime from various growths, weeds, leaves, silt, ashes, sheels, ruts, etc., are also very important contributors to cell types of corrosion. When foreign materials of this nature contribute towards localizing corrosion, the resulting attack is commonly called "deposit attack."

It is known by power plant engineers that the removal of such debris by periodic cleaning using rubber plugs, bristly brushes or high pressure water or air applied at the exit end definitely prolongs the life of condenser tubes. The water box should be cleaned regularly and the paint should be kept intact. Of course, the intake tunnel should be kept clean and if necessary the channel should be dredged. If troubled with marine growth and slime, chlorination may be used. In all instances the metal is corroded (anodic area is pitted or dezincified) where the oxygen concentration is least, viz., where the corrosion film is thickest or under deposits of foreign material which may eventually become part of the corrosion scale. Where a thin deposit covers the metal (cathodic area) and therefore the oxygen concentration is the highest, the least amount of corrosion occurs.



7500 Square Foot Surface Condenser, courtesy Allis-Chalmers Manufacturing Company

Superior Corrosion Resisting Alloys Available

In such alloys as Cuzinal (aluminum brass), Duronze IV (aluminum bronze) and 70-30 copper-nickel, exposed to clean ocean water, the corrosion films are comparatively thin and of a more protective nature. Such films adhere more firmly to the parent metal and are more readily healed when bruised. Consequently the chance of localized corrosion (pitting) is reduced.

Besides reducing corrosion, the thinner corrosion films also possess better heat transfer characteristics than the thicker corrosion films and scales. This results in greater efficiency.

It follows therefore that there is a relationship between the character of the film and condenser tube life. Since the character of this film varies with the alloy and the corrosive environment it behooves every power engineer to seriously consider the superior qualifications of the more modern condenser tube alloys.

Preventive Measures Should Be Taken

Numerous devices have been designed, built and put into practical use to remove debris, entrained gases, and other substances from corrosive waters. The simplest device is the stationary screen which is quite effective within its limits. The rotating screen is widely used and is generally more satisfactory than the stationary screen since the debris, fish, sea weed, etc., are continuously being removed automatically.

The use of a wide generous tank with ample baffles is of proven effectiveness in removing debris and entrained gases. This is accomplished by using a tank which is considerably wider than the incoming stream of water. This slows down the flow sufficiently to allow the foreign matter to settle out from the water and the gases to rise and escape. The use of such tanks materially aids in increasing condenser tube life. It follows that condenser maintenance is appreciably reduced since less debris gets into the water box and the tubes themselves.

Field Tests Strongly Recommended

Many power engineers are looking into the possibilities of these alloys through the installation of test lots under actual service conditions or as field tests so that they will have available pertinent information as to the best alloys for their particular requirements or operating conditions. Here our Technical Service Department can be very helpful in working with power engineers in the selection of the alloy which will be most practical. If you do not have a copy of our Condenser Tube Manual, write for it today.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

office building from panel box to fluorescent units and outlets.

The judges were S. J. O'Brien, president, Electrical and Gas Association of New York, Inc., New York; O. Fred Rost, editor and publisher, *Electrical Wholesaling*, New York; Victor H. Tousley, electrical field engineer, National Fire Protection Association, Chicago; and Laurence W. Davis, general manager, NECA, Washington, D. C.

•

Public Lighting Knowledge Limited, States Consultant

Information on Costs, Quality, and Bulb Life Must be Fed Public to Raise Light Levels

More and better information on lighting and its costs must be passed on to the American public before higher levels and better quality of illumination will be commonly accepted in the home is the deduction drawn by Kathleen Hanway, home lighting consultant, Sylvania Electric Products Inc., in reviewing the findings of the company's second continuing studies of home lighting.

The survey showed that the public is unaware of the simplest facts of present-day home lighting and in some cases uninterested. Of the people interviewed, 60 percent thought there was nothing old fashioned about their lighting although one third of the sockets have bare bulbs, she stated. The remaining 40 percent believed that the lighting was beginning to look old fashioned, and of this group, more than half showed a preference for fluorescent.

When the researchers questioned householders about the cost of burning a 100-watt bulb for ten hours, nearly half could not venture a guess; and of those that answered, approximately two-thirds of the estimates were from 1 to 75 cents too high. Only 14 percent of this group could give the correct figure while an almost negligible percentage guessed too low. Less than one tenth could correctly estimate the life of a bulb.

Miss Hanway concluded her review by stating much public education still is needed. "Every public utility and most local electrical contractors and dealers are ready to furnish information on correct lighting standards and practical means of achieving sufficient high levels of illumination for residential service."

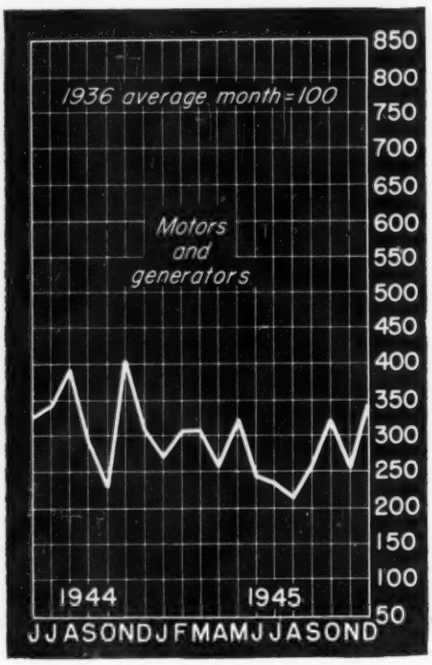
•

Arranges $6,000,000 Loan

Carrier Corp. has made an arrangement with the Marine Midland Trust Co. of New York and other banks to borrow up to $6,000,000.

New Generator Orders Rise 36% in December

Orders received for motors and generators during the month of December advanced 36 percent in comparison with November orders, according to revised



NEMA index, value of orders received

figures released by the National Electrical Manufacturers Association. The index compiled by NEMA moved upward to 345 in December from 254 (revised) in November. In December, 1944, the index stood at 310 (revised), this year's figure representing an increase of 11 percent.

The 1944 and 1945 monthly indexes include an adjustment for cancellations reported up to December 31, 1945. No adjustment has been made for renegotiation of contracts.

•

Westinghouse Develops Low-Cost Budget Program

A new low-cost budget purchase plan covering installment buying of electric appliances and radios has been developed by Westinghouse Electric Corp., according to C. F. Gilbert, manager of the retail finance division.

"The keynote of the new plan is its low cost to the retail buyer, which is a continuation of the downward trend in finance charges apparent over the last decade as more persons began using credit facilities for their purchases," Mr. Gilbert said. He revealed that two separate arrangements for operation of the plan have been completed. In the 37 eastern states, Westinghouse dealers and their customers will have available facilities of the Universal-C.I.T. Credit Corp. A group of 102 banks known as the Western Bankredit Group and coordinated by the Bank of America National Trust & Savings Assn. will provide service in eleven western states.

•

Electrical Manufacturers Increase Plant Facilities

Further expansion of manufacturing facilities have been announced by several electrical manufacturing companies.

New equipment for the manufacturing of Roebling lock-clad aircord, a development which provides improved sensitivity of control at any altitude, is now in operation at the Los Angeles assembly plant of the John A. Roebling's Sons Co. of California. The installation of these additional facilities as an adjunct to the main plant at Trenton, N. J., will provide exceptional delivery service for all points, as well as increased production capacity for a full range of air controls.

Three new appliance and construction materials' manufacturing plants have been leased by the General Electric Co.'s appliance and merchandise department. At Saugerties, N. Y., a 60,000-sq. ft. plant is already in production of fluorescent lampholders and fluorescent starters. At Coxsackie, N. Y., the work of setting up a 14,000-sq. ft. factory that will produce electric heating pads got under way June 1. At Dallas, Tex., the department is establishing a combined appliance service center and attic ventilating fan factory in a 15,000-sq. ft. building at 830 Exposition Ave. This plant is the company's first appliance repair station in the Southwest.

Construction of a new modern streamlined factory for the production of fluorescent and incandescent lamps and other electrical products was begun recently by Duro Test Corp., North Bergen, N. J. The plant, which will house equipment for the production of some of the company's new post-war electrical products, will add 68,000 sq.ft. to the firm's present facilities and will be constructed of steel, concrete and red brick with a continuous steel sash.

•

New Transformer Unit

A specialty transformer department to handle engineering, manufacture, and sale of radio, electronic and other special transformers, has been organized by the Sharon Transformer Division of Westinghouse Electric Corp. The department will be connected with the development of equipment for television broadcasting

and receiving, and commercial adaptations of radar.

Chris H. Bartlett is manager of the new organization, with A. E. Black as general foreman and Frank E. Baker engineering manager.

•

General Cable Holders Vote Recapitalization Program

Stockholders of the General Cable Corp. have approved a recapitalization plan that would eliminate dividend arrears of $52.50 a share on the preferred stock and $4 a share on the Class "A" stock.

The plan called for replacement of 150,000 shares of present 7 percent cumulative preferred with 150,000 each of $100 par 4 percent cumulative first preferred and $50 par 4 percent cumulative convertible second preferred.

Holders of old preferred would have the right to exchange their stock at the rate of one old for one each of the new preferred, plus $12.50 cash and accrued dividends from May 1.

The 306,689 Class "A" shares would be reclassified into common on the basis of 4 common for each "A" held. The company has 671,858 common outstanding out of an authorized 3,000,000.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

ALLEN-BRADLEY CO. has appointed Charles E. Klaus representative for the Portland, Ore., area, with offices at 1233 N. W. 12th Ave. Mr. Klaus is taking over the territory formerly served by Garland-Affolter Engineering Corp.

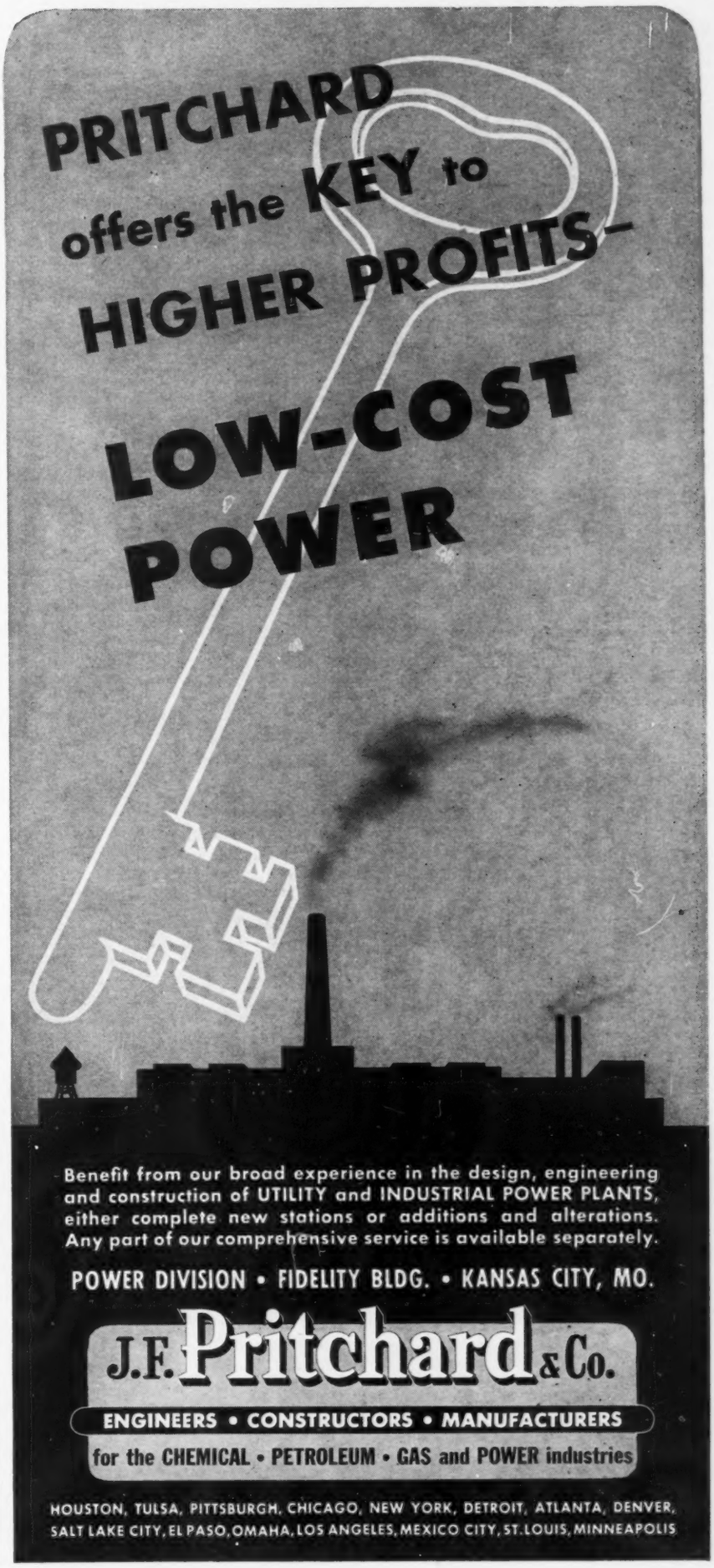
WESTINGHOUSE LAMP DIVISION has named F. C. Cline as manager of the southwestern district. Mr. Cline, who has been acting manager of the district since last July, will continue to make his headquarters in St. Louis, Mo. The southwestern district includes Missouri, Kansas, Colorado, Texas, Oklahoma, Arkansas, New Mexico and parts of Wyoming, Mississippi, Tennessee, South Dakota and Illinois.

HYTRON RADIO & ELECTRONICS CORP., Salem, Mass., has appointed Donald G. Haines as sales and commercial engineer. He will be located at 4000 West North Ave., Chicago, Ill.

•

Calls Price Rise Inadequate

The alloy steel price rise of 4.2 percent granted recently by OPA still is insufficient to cover increased costs, S. E. Bramer, president and general manager of Copper Steel Co., stated. Mr. Bramer said the price boost, coupled with an earlier one of 4 percent, would nevertheless substantially aid the company toward getting a fair return on its operations.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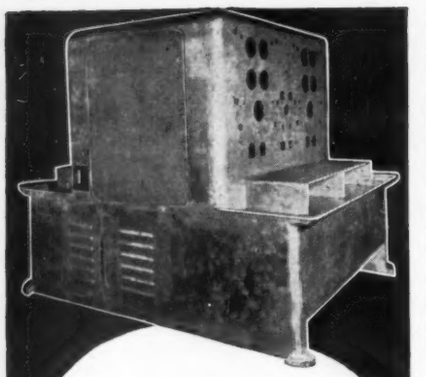

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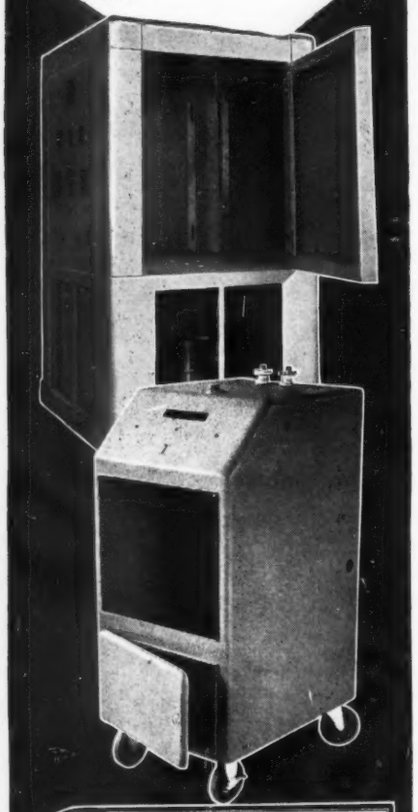

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FIELD REPORTS ON BUSINESS

Despite material shortages and long deliveries on equipment, long-range prospects in the electrical industry are encouraging in view of the pent-up demand for appliances, rural extensions and increased commercial activity in utility operations.

NEW YORK

Indications of greater movement of appliances, interest in coin-operated radios in hotels, and department store interest in electrical cooking have been apparent for some time and recently have become an actuality. One distributor of major appliances has recently signed the largest single order ever reported for food freezing units. The units are of a nationally known brand and will be distributed in the Northeast.

Interest in electrical cooking at quick lunch counters, etc., continues to grow. One of the largest 5 and 10 cent chains is going all out for electrical cooking in the East and expects to convert gradually on a national scale within a three- to five-year period.

More than 50,000 coin-operated radio sets have been contracted for through the Radio-Matic Co. by hotels. These sets will be permanently installed in hotel rooms and will operate two hours upon depositing one quarter.

Retailers are getting ready to battle "discount houses." At a meeting in New York recently the subject was aired and the need for combating cut-price and industrial selling as soon as the period of normal production and consumption is entered, was discussed.

NEW ENGLAND

Despite material shortages and long deliveries on equipment, long-range prospects in this area are encouraging in view of pent-up demand for appliances, rural extensions, increased commercial activity in utility operations, and the carrying forward of plant developments looking toward more efficient service and increased usage of electricity in innumerable fields. Interest in street lighting is increasing. Worcester Suburban Electric will install 16 more mercury vapor lamps of 16,000-lumen rating in addition to 23 already determined upon for Marlboro, Mass. Stamford, Conn., will replace all 60-cp. lamps with 100-cp.'s.

Peabody, Mass., has retained J. R. Worcester & Co., Boston engineers, to report on future developments in its municipal electric plant. A new station to cost approximately $1,000,000 is being studied in relation to increased purchase of energy.

Grenby Mfg. Co., Plainville, Conn., has installed modern wiring including 225-amp. runs of Trumbull type "FVK" "Flex-A-Power" conduit and cable connections and a control center with a 1,000-amp., three-phase, 250-volt main breaker for incoming utility service feeding 100- and 200-amp. factory mains.

Surplus government property at the U. S. Naval Supply Depot, Davisville, R. I., including about $1,000,000 worth of wire, cable (No. 1, 6, 14 and 17 gage), rubber and braid covered, building and telephone, flashlight, medium and mogul base lamps, cartridge, link and plug fuses, conduit fittings, switch and outlet boxes, attachment plugs, etc., is being sold at the site to July 3, subject to priority allocations to Federal agencies, veterans, the RFC for small business, government, non-profit institutions, and July 1-3 to non-priority groups.

CHICAGO

Local dealers and manufacturers of major electrical fittings and supplies estimate that close to 40 percent of business which they formerly planned to transact in 1946 must now definitely be put off to 1947. Demand is brisk, but slow deliveries, general uncertainties and other factors have tied up production badly. It is difficult to complete a product because of the shortage of key items. As a result, inventories are piling up to an unprecedented level. The largest blockade seems to be in cast iron and porcelain. Although the copper shortage has not yet been felt in some lines, it is expected soon to result in a complete famine, unless early relief is in sight.

Electrical houses in this area have felt the strong demand from Florida as a result of a campaign (interrupted by the war) for placing of distribution lines underground. In some areas particularly affected by storms, it is planned to carry this program through 100 percent.

General Electric Co. is believed to be planning a factory in Milwaukee to manufacture air-conditioning equipment. Negotiations are under way for the purchase of an Allis-Chalmers war plant. General Electric X-Ray Corp., a subsidiary, manufacturer of x-ray and other electromedical apparatus, and industrial x-ray machinery, recently was successful bidder on the Allis-Chalmers Supercharger plant No. 1 in Milwaukee, to which it will eventually move its entire operations, now in Chicago. The new plant will permit streamlining and expansion of production.

PACIFIC COAST

Electrical material shortages are now more a matter of degree than absolute, though a few such items as ½-in. locknuts and even porcelain knobs and tubes are almost nonexistent along the Pacific Coast and are even causing construction bottlenecks. The most serious potential shortage is insulated copper wire in all styles and service uses.

New price increases cover electricians' and linemen's tools, house goods, and an industry group increase of from 10 to 15 percent on all lines of externally operated switches, panel boards and accessories. Such uniform price advances on comparable lines simplify their billing and order filling; whereas it is felt that OPA's handling of conduit fittings, for example, with varying rates and times of increase to different manufacturers, may create the very spiraling of prices which OPA was designed to prevent.

Large projects which have opened bids after several postponement are Rio Grande, with $180,000 of transformers, breakers, disconnects and arresters, with Westinghouse low on the largest schedule; and a similar assortment for Davis Dam on the Colorado, with Allis-Chalmers low at $131,468.

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Grey Foundry Iron Shortage Eased by Magnesium

Critical shortages of material essential to grey iron foundry operations have resulted in wide industrial substitution of magnesium castings for iron parts, John F. Conroy, III, president of the National Magnesium Corp., Elkton, Md., stated recently.

Deluged with the greatest backlog of orders in the history of the industry, grey iron founders have been handicapped in their production by recent Government lumber restrictions and dwindling stockpiles of coal and coke.

In an effort to break this peace-time bottleneck, users of this type of casting have turned to other metals to replace parts in their original designs calling for grey iron.

Magnesium is being widely used as a replacement since its alloys can be fabricated by practically all of the known methods. Magnesium alloys may be sand-cast, cast in permanent molds, die-cast, rolled, formed, forged or extruded. It can be torch-welded, arc-welded or spot-welded as specifications indicate, he said.

•

Electronics Exposition Set

The electronics industry will have its own exposition this fall in New York at the Grand Central Palace from October 14 to 19. It is planned to design the exposition under three broad categories—Communications, broadcasting and industrial applications. The purpose of the exhibition, according to its managers, Harry G. Cisin and V. M. Eitingon, of Electronic Exihbitors, is to show the American public war-time advances in electronics and how they have been harnessed to peace-time uses.

•

Raytheon Merger Completed

Merger of Submarine Signal Co. into Raytheon Manufacturing Co. was consummated on May 31, pursuant to agreement of merger, dated April 24, 1946, between the two companies, after adoption by the required vote of the stockholders of each company, Laurence K. Marshall, president of Raytheon, has announced.

•

Makes Change in Name

The corporate name of the Warren Telechron Co., Ashland, Mass., has been changed to Telechron Inc., I. W. Kokins, president, has announced. The purpose of the change, he said, was to relate the name Telechron more closely to the company's products.

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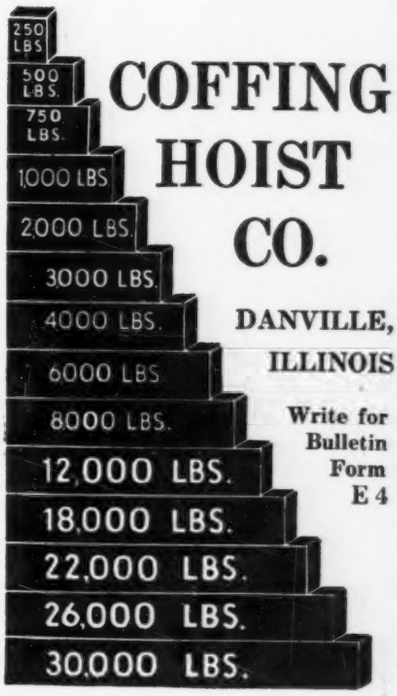

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SALES OPPORTUNITIES

MARYLAND—Consolidated Gas, Electric Light & Power Co., Baltimore, has plans maturing for proposed expansion in Riverside generating station and contract is being awarded for steel framing for multi-story addition to present building. Installation will include new turbine-generator and accessories, high-pressure boilers and auxiliary equipment. Switchyard capacity will be increased and extensions made in transmission lines. Entire project estimated to cost approximately $6,500,000.

CALIFORNIA—City Manager, H. T. Stites, Burbank, will receive bids until July 2 for 20,000-kw. turbine-generator and accessory equipment for installation in municipal power plant (Specifications 360). This is part of development program to be carried out at station. Public Service Department, 174 West Magnolia Blvd., in charge.

MICHIGAN—Dow Chemical Co., Midland, has plans for expansion in plant, comprising several new buildings, with machinery and electrical equipment. Cost about $1,250,000. CPA permission has been secured and work will be placed under way soon. Company also has authorized addition to magnesium plant at Freeport, Tex., with installation of equipment in caustic division and other departments.

WISCONSIN—State Department of Public Welfare, State Capitol, Madison, has authorized plans for new steam-electric power plant at Northern Wisconsin Colony and Training School, Chippewa Falls. Also for similar power station at State Hospital, Winnebago. Bids will be asked in near future. Gates, Moe & Weiss, 611 North Broadway, Milwaukee, are consulting engineers for both projects.

NEW YORK—U. S. Engineer Office, Chimes Building, Syracuse, will receive bids until July 2 for construction of power and lighting system at new East Sidney dam, Ouleout Creek, Delaware County, for which bids are being asked at same time (Inv. 30-180-46-27).

ILLINOIS—Borden Co., 350 Fifth Ave., New York, N. Y., has plans maturing for group of four new five and six-story buildings for proposed new soy bean extraction plant at Kankakee, where work is under way on number of miscellaneous structures, including grain elevator. New buildings will be equipped with processing and other machinery and electrical equipment for large capacity. Entire program will cost close to $1,200,000, and is scheduled for completion early next year. James Stewart Corp., 231 South LaSalle St., Chicago, is engineer and in charge of erection.

IOWA—Town Council, Pella, will receive bids until July 2 for addition to municipal steam-electric generating station. Capacity will be increased. Brown Engineering Co., K. P. Bldg., Des Moines, Iowa, is consulting engineer.

KENTUCKY—City Council, Paris, has plans nearing completion for expansion in municipal power plant, including addition to present building and installation of equipment for increased capacity. E. C. and G. T. Landberg, 114 Garfield Pl., Cincinnati, Ohio, are architects.

FLORIDA—Tampa Electric Co., Tampa, is reported planning new generating station on local site, with turbine-generators, high-pressure boilers and auxiliary equipment for large capacity. Project will include extensions in transmission and distribution lines, with total cost approximating $5,000,000.

MARYLAND—Bethlehem Steel Co., Sparrows Point, Baltimore, plans new main motor room at local steel mill, one-story, 65 by 775 ft., with heavy-duty motor units and accessories. Cost reported close to $175,000, with equipment. Work will be placed under way soon.

NEW YORK—State Hospital Department, Albany, has authorized plans for new power plant at Buffalo State Hospital, Buffalo, to cost approximately $709,000, with equipment. Bids are expected to be asked in near future. York & Sawyer, 101 Park Ave., New York, are architects.

PENNSYLVANIA—Neville Island Glass Co., Inc., Pittsburgh, recently organized, care of Richard M. Marshall, executive vice-president, Pittsburgh Coke & Chemical Co., Grant Bldg., Pittsburgh, has plans under way for new plant for production of glass bottles and containers on tract of about 5 acres of land on Neville Rd., Neville Island, acquired from Pittsburgh Coke & Chemical Co. It will comprise a number of one and multi-story buildings, with automatic feeders and other machinery and electrical equipment for initial rating of about 300,000 bottles daily. A power substation and boiler house are planned. Cost estimated about $1,100,000. Financing is being arranged through sale of stock and work will begin at early date. Completion is scheduled by close of year. Walkerman D. Dugan is president.

OHIO—Municipal Light Department, Columbus, has plans under way for expansion in municipal power station, including addition to present building, with installation of new turbine-generator, boilers and auxiliary equipment. The cost is estimated at about $1,000,000. Bids are scheduled to be asked in near future.

WASHINGTON—Public Utility District No. 1, Klickitat County, White Salmon, has plans maturing for extensions in transmission and distribution lines in parts of Klickitat County, requiring about 1,733,000 lin. ft. No. 2 copper wire; 25,000 lin. ft. No. 4-A copperweld and 1,241,000 lin. ft. No. 8 copperweld; 1,733,000 lin. ft. No. 0 ACSR; 25,000 lin. ft. No. 2 ACSR; and 3,166,000 lin. ft. No. 4, ACSR. Also, 2,000 guy assembly units; 2,000 anchor assembly units; 415 transformers, rating 1½ to 15 kva; 3,700 secondary assembly units; 730 service drop assembly units; 2,800 34.5-kv. pin-type insulators; 200 10-in. disc suspension-type insulators; 700 6-in. suspension-type insulators. New lines will approximate 265 miles and are estimated to cost $600,000. Bids will be asked soon. James B. Carey & Associates, Alaska Trade Bldg., Seattle, are consulting engineers.

WISCONSIN—City Council, Oconto, has authorized immediate call for bids for installation of floodlighting system at athletic field. Municipal Park Board is in charge.

Recent Rate Changes

OKLAHOMA GAS & ELECTRIC Co.'s electric rates in Arkansas have been reduced 4.7 percent, or approximately $65,500 annually, effective July 1, by an order issued by the Arkansas Public Service Commission. The order established new rate schedules for 40 different classes of service. The reductions include the following: residential, $20,200; general service, $20,100; municipal street lighting, $9,150; combination light and power, $8,700; rural residential, $3,040; county, municipal and schools, $1,600.

CLEVELAND ELECTRIC ILLUMINATING Co.'s appeal from an ordinance passed by City Council two years ago, enacting lower electric rates, is being heard by the Ohio Public Utilities Commission. Counsel for the company told the commission that any rate reduction was impossible because of the company's low earnings for the last several years, together with rising costs of many items. Utility officials said the reduction would cost $2,000,000 a year in revenues, while A. P. Learned of the city staff set the figure at $1,200,000. The company is collecting under the old schedules, with the difference between the two rates impounded for return either to the 360,000 residential and small commercial customers or to the company, depending on the outcome of the case.

COMMUNITY PUBLIC SERVICE Co.'s electric rate schedule in Alamogordo and Tularosa, N. M., has been ordered investigated by Gov. John J. Dempsey of New Mexico. The Governor has asked W. W. Nichols, chairman of the State Public Service Commission, to call a hearing "to determine if reductions can be granted consumers."

CITIZEN'S UTILITIES Co., a Minnesota corporation serving Kingman and Nogales, Ariz., has been requested by the Arizona Corporation Commission to revise its rates downward. Reprimanding the utility for failing earlier to fall into line with most Arizona utilities in schedule revisions, and for supplying inadequate long-term debt information in its annual report, W. J. Eden, commission member, recently wrote H. B. Atkins, vice-president of Citizen's Utilities, asking that immediate action be taken in adjustment of rates.

MINERAL COUNTY power system in Nevada has been authorized by the county utility board to reduce its power rates by means of an increase in the amount of cash discount allowed on bills when paid by a specified date. Under the arrangement, the residential discount is increased from 5 to 10 percent, and the light commercial discount (previously non-existent) is set at 10 percent.

BUSH UTILITY Co., Parker, Ariz., will slash its power rates 10 percent, subject to approval by the Arizona Corporation Commission, with reductions to be retroactive to May 1.

MARYVILLE (Tenn.) electric rates will be reduced, effective July 10, an average of 26 percent to residential consumers; 21 percent to commercial users, and 14 percent to industrial customers, the City Board of Public Utilities has announced. Savings to consumers, based on present use of electric energy, will approximate $61,000 annually.

MALHEUR COOPERATIVE ELECTRIC ASSOCIATION, Vale, Ore., has been authorized by REA to make a rate reduction of 11 percent in water heating rates and in the minimum bill from $1.75 to 75 cents. The system consists of 324 miles of line, serving 519 members in Malheur and Baker counties, Ore., and in Payette County, Idaho.

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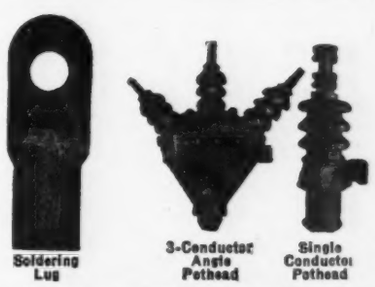

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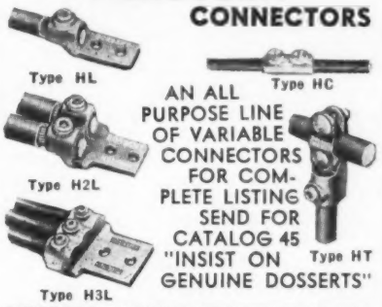

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REA Allots $33,209,370 to Rural Co-ops

The Rural Electrification Administration has recently approved loan allotments totaling $33,209,370 to 128 rural cooperatives in 33 states, to provide electric service to farms and other rural establishments. The largest of the loans are:

ALABAMA—Black Warrior Electric Membership Corp., Demopolis, $600,000; Sand Mountain Electric Cooperative, Fort Payne, $525,000; Baldwin County Electric Membership Corp., Robertsdale, $382,000.

FLORIDA—Clay Electric Cooperative, Inc., Keystone Heights, $584,000.

GEORGIA—Colquitt Electric Co., Moultrie, $460,000; Satilla Rural Electric Membership Corp., Alma, $436,000; Coweta-Fayette Electric Membership Corp., Newman, $352,000; Forsyth County Electric Membership Corp., Cumming, $310,000.

ILLINOIS—Wayne-White Counties Electric Cooperative, Fairfield, $570,000; Illinois Rural Electric Co., Winchester, $565,000; Tri-County Electric Cooperative, Inc., Mt. Vernon, $525,000.

IOWA—Eastern Iowa Light & Power Cooperative, Davenport, $475,000.

KANSAS—Sekan Electric Cooperative Assn., Inc., Girard, $427,000; Summer-Cowley Electric Cooperative Assn., Inc., Wellington, $360,000; Ninnescah Rural Electric Assn., Inc., Pratt, $353,000; Nemaha-Marshall Electric Cooperative Assn., Inc., Axtell, $345,000; C. & W. Rural Electric Cooperative Assn., Inc., Clay Center, $337,000; Jewell-Mitchell Cooperative Electric Co., Ionia, $316,000; Norton-Decatur Cooperative Electric Membership Co., Inc., Norton, $301,000.

KENTUCKY—Pennyrile Rural Electric Cooperative Corp., Hopkinsville, $545,000; Cumberland Valley Rural Electric Cooperative Corp., Corbin, $478,000.

LOUISIANA—Valley Electric Membership Corp., Natchitoches, $585,000.

MARYLAND—Choptank Electric Cooperative, Inc., Denton, $687,000.

MINNESOTA—North Pine Electric Cooperative, Inc., Finlayson, $300,000.

MISSISSIPPI — East Mississippi Electric Power Assn., Meridan, $525,000; Tallahatchie Valley Electric Power Assn., Batesville, $500,000; Coast Electric Power Assn., Bay St. Louis, $470,000; Four-County Electric Power Assn., Columbus, $355,000.

MISSOURI—Tri-County Electric Cooperative Assn., Lancaster, $334,000.

NEBRASKA—Niobrara Electric Membership Assn., Hay Springs, $489,000; Cedar-Knox County Rural Public Power District, Hartington, $370.000.

NEW MEXICO—Central Valley Electric Cooperative, Inc., Artesia, $365.000.

NORTH CAROLINA—Davie Electric Membership Corp., Mocksville, $639.000; Randolph Electric Membership Corp., Asheboro, $414,500; Blue Ridge Electric Membership Corp., Lenoir, $360.000.

NORTH DAKOTA—Nodak Rural Electric Cooperative, Inc., Grand Forks, $550.000.

SOUTH CAROLINA—Santee Electric Cooperative, Inc., Kingstree, $508.000.

SOUTH DAKOTA—Readle Electric Assn., Inc., Huron, $585.000; Cam-Wal Electric Corp., Selby, $500.000; James River Valley Electric Assn., Aberdeen, $300.000.

TENNESSEE—Cumberland Electric Membership Corp., Clarksville, $600.000; Volunteer Electric Cooperative, Decatur, $531.000.

TEXAS—New Era Electric Cooperative, Inc., Athens, $395.000; Jackson Electric Cooperative, Inc., LaWard, $321.000.

WISCONSIN—Dairyland Power Cooperative, LaCrosse, $500,000.

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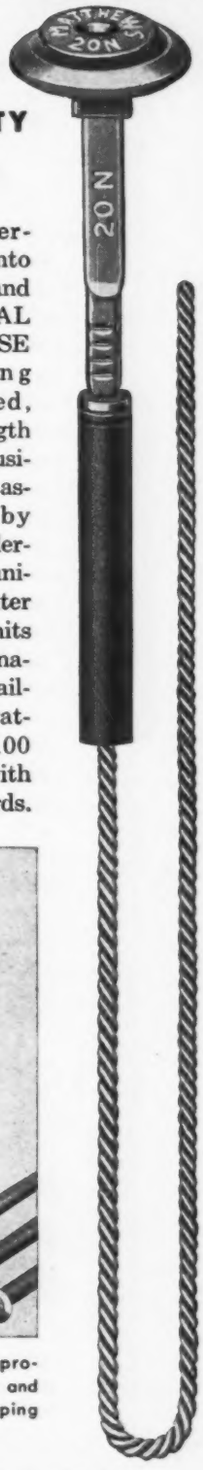

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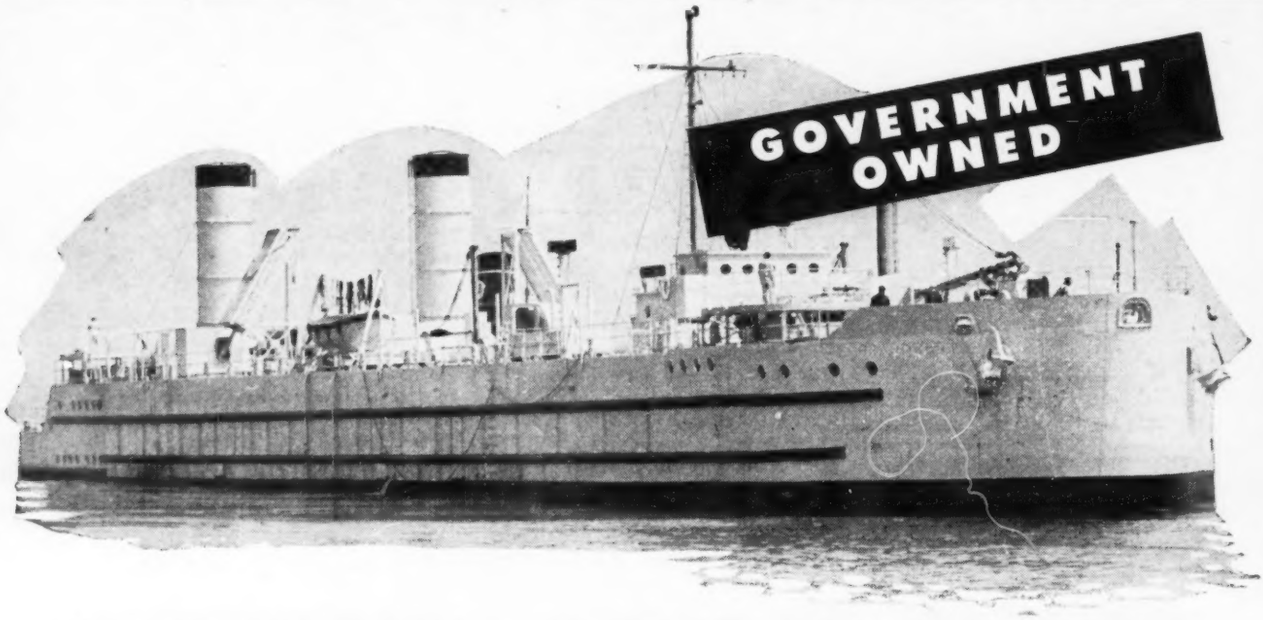

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